The requirement for an ultimate permanent solution to the waste problem would remain even if the Proposed Action was not carried out. Chapter 7 of the EIS discusses the potential environmental impacts of the No-Action Alternative.

## 7.4 Repository Accidents

**7.4 (41)**
**Comment** - 3 comments summarized
Commenters stated that human error is a common initiator for accidents, citing examples of the recent nuclear accident at the Tokaimura nuclear fuel plant in Japan and past accidents in Russia and elsewhere. Commenters suggested that DOE has completely ignored human error as an accident initiator for any stage of repository construction, operation, monitoring and closure.

**Response**
DOE agrees that human error is a potential accident initiator and has considered human error in the EIS in the analyses of potential accidents. Appendix H of the EIS documents an analysis of potential accidents that could happen at a repository. The range of accidents considered includes events that could be initiated from both human error (for example, fuel assembly drop accidents) and external events (for example, earthquakes and volcanoes). Appendix H and its references describe the applicable analyses and the results. The results of a set of 10 potential accidents (based on screening described in Appendix H) are shown in Tables 4-36 and 4-37 of the EIS. Impacts to any member of the public resulting from the complete spectrum of credible events (those having an annual probability of 1 chance in 10 million or greater) would result in a radiation dose of no more than a few millirem even if no action was taken to avoid exposure after an accident occurred. Spent nuclear fuel handling and transportation operations would be designed so that the consequences of accidents caused by human error are limited and localized. For example, during transfer operations, lifting heights would be limited so that accidental drops of radioactive material would not be expected to result in an uncontained release of radioactive material.

**7.4 (67)**
**Comment** - 3 comments summarized
Commenters expressed concern over the selection of older fuel for accident analysis in the DEIS and the fact that the Supplement did not consider transportation analysis.

**Response**
As a result of similar comments on the Draft EIS, DOE has reevaluated the fuel characteristics used for the base case accident analyses based on a hazard index approach as described in Section A. 2.1.5. The revised fuel used for the analyses in the Final EIS is younger than the fuel used in the Draft EIS. For example, the pressurized-water reactor fuel now used in the accident analyses ("representative" fuel) is 15 years old rather than 26 years old as assumed in the Draft EIS. DOE has also performed sensitivity analyses to determine the relationship between accident impacts and fuel characteristics. These studies indicate that the hottest fuel to be received at the repository (5 years old) would produce impacts about 3 times higher than the representative fuel selected for the analysis. Accidents involving transportation casks and waste packages would not involve only the hottest fuel because licensing limitations preclude loading these containers with only the hottest fuel.

Transportation analysis is beyond the scope of the Supplement to the Draft EIS. As indicated in Section 1.2 of the Supplement, the scope was limited to changes in the proposed repository design and operating modes. The transportation analysis has been extensively revised for the Final EIS to incorporate the new fuel characteristics and other relevant information (See Chapter 6 and Appendix J).

**7.4 (87)**
**Comment** - 10 comments summarized
Commenters were concerned about the potential impact of catastrophic accidents at Yucca Mountain. Such catastrophic event cited included seismic events, a nuclear meltdown, meteor strikes, and impact from aerospace objects originating from proposed launch facilities at the Nevada Test Site. Some commenters stated that the impacts of such events would be compounded by concentrating the nuclear waste at one repository as opposed to scattered storage locations.

**Response**
The EIS evaluates impacts from a spectrum of potential accident scenarios, from minor events to highly improbable natural phenomena such as beyond-design-basis earthquakes (1 chance in 50,000 per year). Appendixes H and I of the EIS describe the results of these evaluations for repository operations (preclosure), and long-term impacts (postclosure), respectively. Because of the nature of the waste and its confinement in strong corrosion-proof containers in underground drifts (tunnels), the proposed repository would offer considerable protection to the environment from any credible event (a probability of 1 chance in 10 million per year or higher). A nuclear meltdown from heat generated by the waste would not be possible. The temperature of the waste would be strictly controlled by waste package spacing and ventilation. If the forced ventilation system failed, ample time would be available to restore ventilation capability because heat-up of the waste packages would be very slow and several years would be available before waste package temperatures would approach levels that could result in a radionuclide release.

With regard to aerospace activities, DOE examined both existing activities and the potential for future activities that could pose a threat to the repository (see Section H.2.1.3 of the EIS). Two such activities were determined to be potential threats; the Kistler Aerospace activities and the Wahmonie rocket launch facility could initiate accidents at the repository from rocket impacts. The Wahmonie activities, which involved rocket launches from a location several miles east of the repository site, have ended (DIRS 104722-Wade 1998), so this facility would pose no risk to the repository. The Kistler Aerospace activities would involve launching rockets from the Nevada Test Site to place satellites in orbit (DIRS 101811-DOE 1996). However, the Kistler Aerospace activity is currently on hold (DIRS 157108-Jason 2001), and there is insufficient information to determine if this activity could pose a threat to the repository. If the project moved forward, DOE would evaluate its potential to become an external accident-initiating event.

DOE also examined the potential for a meteorite strike on both the Waste Handling Building and the surface aging facility and found such an event to be noncredible (probability less than one in 10 million). This analysis is provided in Section H.2.1.3 of the EIS.

**7.4 (103)**
**Comment** - 2 comments summarized
Commenters were concerned that any possible resumption of underground nuclear weapons testing at Nevada Test Site could adversely affect repository operations or long-term isolation of spent nuclear fuel and high-level radioactive waste.

**Response**
Potential impacts from underground testing at the Nevada Test Site were evaluated in 1996 in the *Nevada Test Site Environmental Impact Statement* (DIRS 101811-DOE 1996). The evaluation concluded that the only impact such testing could impose on the repository would be ground motion associated with the energy released from the detonation of the weapon. These ground motion effects were determined to be not limiting for the seismic design criteria. In other words, the design-basis earthquake for the repository was determined to provide the greatest ground motion effects. Therefore, because the repository has been designed to survive the design-basis earthquake with minimal damage, ground motion resulting from any resumption of underground testing would be unlikely to result in any substantial damage to the repository or its contents. Section H.2.1.3 of the EIS provides a discussion of external events including those that could occur from military activity such as resumed nuclear testing on the Nevada Test Site.

**7.4 (125)**
**Comment** - 17 comments summarized
Commenters stated that the dry spent fuel surface aging facility should be evaluated for accidents. Commenters also suggested that the facility could not be licensed because of the local seismic conditions.

**Response**
Accidents involving the spent nuclear fuel storage modules in the surface aging facility and the Waste Handling Building are evaluated in Section H.2.1.3 of the Final EIS. Aircraft crashes and beyond design basis earthquake events are explicitly considered. As noted in Section H.2.1.3, a significant earthquake event could cause the modules to tip over, but the storage canisters and welded seams would withstand such events without damage.

Regional volcanoes were found to be credible, but the only consequence of such an event would be minor ashfall at the repository which would have no effect on the storage modules. Because there would be only very small quantities of surface contamination on the storage modules or casks, storm runoff would not represent a substantial source of radioactive contamination. The fuel storage facility would comply with all applicable Nuclear Regulatory Commission licensing requirements, which would include seismic design criteria specific to the repository and therefore would be licensable by the Commission.

**7.4 (207)**
**Comment** - 4 comments summarized
Commenters indicated that they believe that an aircraft crash could cause a real problem if it crashed into repository surface facilities. Commenters also expressed concern that an aircraft crash on the surface could result in immediate or delayed subsurface impacts such as exploding ordnance or rock fracturing. Some stated that DOE had not analyzed this possibility well enough.

**Response**
During normal operations, shipping casks that arrive at the repository would be unloaded and the contents moved either to a dry storage staging (surface aging) area or into the Waste Handling Building. Although dry storage staging (surface aging) was not evaluated at the Yucca Mountain site in the initial Draft EIS, the potential consequences of an aircraft crash into dry storage facilities were evaluated at the generator sites for the No-Action Alternative (Section 7.2.1.8) and for the repository retrieval scenario (Section 4.2.1.2.8). In both cases penetration potential of above-ground storage facilities by aircraft components was determined not to be sufficient to breach the containers. The EIS has been updated to specifically address the potential consequences of an aircraft crash into dry storage staging (surface aging) facilities at Yucca Mountain. The analysis results continue to show that no breach of waste containers or release of radioactive materials would occur.

Some military aircraft from Nellis Air Force Base carry explosive ordnance. However, this ordnance is not armed until the aircraft arrives at the Nellis Air Force Range (now called the Nevada Test and Training Range), north of the proposed repository location. As a consequence, an aircraft mishap near the proposed repository would be unlikely to detonate any ordnance carried by the aircraft. In the Safety Evaluation Report for the Private Fuel Storage project in Utah, the probability of unarmed live ordnance exploding while being carried on board a crashing aircraft was conservatively estimated to be 1 percent (0.01) (DIRS 154930-NRC 2000). Because the crash probability onto dry storage modules is only slightly above the 1 chance in 10 million, the probability that a crash would involve a plane carrying live ordnance that explodes would be about 1 chance in 1 billion per year. DOE regards such a scenario as not reasonably foreseeable.

As indicated in Section H.2.1.3 of the EIS, aircraft crash impacts into the Waste Handling Building that could cause damage to the stored fuel are not credible (a probability of less than 1 chance in 10 million per year). However, DOE decided to evaluate an aircraft crash into the repository due to the potential for large impacts. The results are provided in Section H.2.1.5.1.

The repository design calls for the subsurface structures, including waste packages and support systems for the emplacement drifts, to withstand the effects of a large earthquake (a once-in-10,000-year event) without a release of radioactivity. The waste packages in the drifts would be under at least 200 meters (660 feet) of rock overburden. As a consequence, the impact of a jet aircraft crash on the surface, with a relatively small energy input to the mountain compared to an earthquake, would be unlikely to cause any disruption in the emplacement drifts. Furthermore, a recent analysis (DIRS 150276-CRWMS M&O 2000) evaluated the impact of a hypothetical failure of an underground waste package with damage to all fuel assemblies and concluded that the dose to a member of the public at the nearest repository land withdrawal boundary would be small (2.66 millirem).

**7.4 (241)**
**Comment** - 26 comments summarized
Commenters stated that the blending pools had not been considered in the accident analysis, particularly with respect to the beyond design basis earthquake evaluated in the DEIS. Also of concern was the potential for criticality and the potential for heatup of the fuel stored in the blending pools if water were lost, and contamination of surface water and groundwater from the pool water. Commenters were concerned about the effects of an earthquake

occurring during the blending process as well as the effect of incorrect record keeping. Others were concerned that the design detail was not sufficient to allow an adequate safety analysis.

**Response**

DOE agrees that it is likely that the portion of the Waste Handling Building that encloses the fuel pools would also collapse in the beyond-design-basis seismic event evaluated in the EIS. However, this portion of the Waste Handling Building would be a type of construction that would not result in heavy construction debris that could fall into the fuel pools and cause extensive damage to the stored fuel assemblies. The 15-meter (50-foot) depth of the fuel pool would also limit the velocity of impact (and, therefore, assembly damage) of any debris that could enter the pool from the postulated earthquake. Furthermore, if a radionuclide release occurred from damage to fuel assemblies, the release would be very small because the radionuclides contained in fuel pellet particles would be retained in the pool water. In the Final EIS accident analysis, such releases were postulated to occur from fuel assembly handling accidents in the pool, and only minimal releases were estimated (see Appendix H of the EIS for further discussion). The earthquake could damage the walls and floor of the fuel pools, although a recent assessment for similar pools at nuclear powerplants concluded that the pool enclosures have significant capacity to resist seismic loads. Because the pools would be below ground level, the compact geologic media that surrounds the pool walls and floor would limit the leakage rate from the pool. The steel liner in the pools would also assist in limiting leakage. Since the fuel assemblies would have been aged at least 5 years prior to arrival at the repository, rapid heatup would not be possible. The assemblies could be stored in dry surface storage with no active cooling required. A recent evaluation by the Nuclear Regulatory Commission determined that the maximum cooling time to prevent radionuclide release from overheated fuel in a storage pool after loss of water could be as much as 5 years under conservative adverse circumstances (all surrounding fuel cooled 5 years or less, high density storage, impaired ventilation). All of the fuel in the pools would be cooled at least 5 years (the estimated maximum average cooling time would be 11 years), and the conservative circumstances cited in the Nuclear Regulatory Commission analysis would be unlikely to exist.

The water handling and treatment systems for the inventory (blending) pools and safety measures planned are described in the Science and Engineering Report (DIRS 153849-DOE 2001). With respect to the source of water for repository operations, including the pools, DOE filed suits on March 2, 2000, in the U.S. District Court for the District of Nevada, and on March 3, 2000, in Nevada's Fifth Judicial District Court for injunctive relief to overturn the Nevada State Engineer's Ruling No. 4848, dated February 2, 2000, denying DOE's water-appropriation request for 430 acre-feet per year for repository construction and operation. The State Engineer based his denial on a finding that the requested use threatened to prove detrimental to the public interest. On September 21, 2000, the U.S. District Court Judge granted the State's motions to dismiss the DOE lawsuit. DOE appealed this ruling on November 16, 2000. On October 15, 2001, the Ninth U.S. Circuit Court of Appeals ordered a Federal judge to hear the DOE's suit. The case is pending. DOE has not developed any other plans to acquire water for the proposed repository. Depending on the final ruling of the State Court, DOE might consider other options to carry out its responsibilities under the NWPA.

As discussed in Section H.2.1.3 of the EIS, flash floods could occur in the vicinity of the repository (DIRS 100204-CRWMS M&O 1996). However, an earlier assessment (DIRS 103237-CRWMS M&O 1998) screened out severe weather events as potential accident-initiating events primarily by assuming that operational rules would preclude transport and emplacement operations whenever there are local forecasts of severe weather. A quantitative analysis of flood events (DIRS 104699-Jackson et al. 1984) concluded that the only radioactive material that extreme flooding would disperse to the environment would be decontamination sludge from the waste treatment complex. The doses resulting from such dispersion would be limited to workers, and would be very small (DIRS 104699-Jackson et al. 1984). A more recent study reached a similar conclusion (DIRS 101930-Ma et al. 1992).

Less severe storm flooding events would not be expected to carry contaminated water into nearby rivers because the design would include a storm drainage control and collection system to contain water runoff and prevent spillage over the fill slopes. A retention pond would be built to prevent stormwater pollution. Further, there are no rivers in the vicinity of the repository to transport contaminated water. Casks in the aging facility would not contain significant amounts of radioactive contamination on their surfaces, and casks would be monitored for leakage and repaired if leakage was detected. Accidents involving the surface aging facility are considered in Section H.2.1 of the EIS.

The criticality potential resulting from displaced, crushed, and damaged fuel assemblies has been evaluated by the Nuclear Regulatory Commission for spent nuclear fuel storage at nuclear power plants (DIRS 156712-NRC 2001). The conclusion reached by the Commission was that spent nuclear fuel pool criticality would pose no meaningful risk to the public. This conclusion is considered applicable to the fuel pools because they would be designed and operated consistent with Commission regulations. Additional consideration of the likelihood and consequences of criticality events is provided in Section H.2.1 of the EIS. DOE intends to continue to evaluate criticality potential in the pools.

Blending is merely the selective loading of disposal containers to control waste package temperature. Accidental assembly drops during handling and loading operations are evaluated in Appendix H of the EIS and impacts from such accidents are provided in Section H.2.1.5. Releases from assembly drop accidents in the pool would be mitigated by retention in the pool water, and all accidents within the confines of the Waste Handling Building would be mitigated by the ventilation system, which would control the flow of any radioactive release and filter any airborne discharge to the atmosphere. Misloading of a waste package could occur, and such events could result in excessive temperatures. The possibility of such events has been considered, and it is expected that disposal container loading procedures would be developed based on thermal analyses of the various waste package configurations such that sufficient margin would be available to ensure that temperature criterion would not be violated for any credible misload (DIRS 150198-CRWMS M&O 2000).

The processes planned for the blending commercial spent nuclear fuel are the same as those being used successfully for fuel management at nuclear plants throughout the United States. The nuclear industry has been using historical data for many years as the basis for performing core reload and criticality calculations and has an excellent record for accurately predicting the response of the reactor. The records and data that would be used for fuel blending are the same records that the utilities have used to calculate core reloads and criticality.

With regard to the completeness of facility design, the level of discussion in the EIS is similar to the description of the other operational characteristics of the waste handling process. As described in the Science and Engineering Report (DIRS 153849-DOE 2001) and the Preliminary Site Suitability Evaluation (DIRS 155950- and 154659-BSC 2001), DOE believes that the engineering design of the Waste Handling Building has been developed to the extent necessary to allow estimation of potential accidents and resulting environmental impacts, consistent with the National Environmental Policy Act.

**7.4 (2943)**
**Comment** - EIS001051 / 0002
This information is inadequate and doesn't address accident exposure as a result of accidents nor does it address downwind effects of radiation exposure, potential ground water contamination or the risk of exposure to health professionals in the Las Vegas area.

**Response**
The EIS addresses both the probability and potential consequences of accidents. Section 6.2.4 and Appendix J of the EIS discusses potential consequences of transportation accidents. Section 4.1.8 and Appendix H address potential accidents during preclosure repository operations, and Chapter 5 analyzes the potential for groundwater contamination thousands of years after the emplacement of spent nuclear fuel and high-level radioactive waste in the proposed repository. To ensure that the analyses did not underestimate the impacts, they assumed no implementation of intervention or institutional controls to mitigate the consequences. Even in the most severe accidents (annual probability of less than 1 chance in 5 million), DOE expects negligible radiation exposure to anyone not directly involved in the accident, including health care professionals.

In response to public comments, the EIS contains additional information on Federal, state, Native American tribal, and local responsibilities and preparedness for emergency response to accidents involving radioactive material shipments (see Section M.6). Section M.8 discusses the Price-Anderson Act, which provides for liability insurance to redress costs of accidents involving releases of radioactive materials to the environment. In addition, Sections J.1.4.2.5 and H.2.1.5 include a range of cost estimates for cleanup and restoration following transportation and repository accidents, respectively.

**7.4 (3363)**
**Comment** - EIS001242 / 0012
If an accident happens, who will be contaminated downwind/how far will the contamination reach in the air?

**Response**
The maximum reasonably foreseeable accident at the repository would be a large earthquake that collapsed the Waste Handling Building and damaged fuel assemblies inside the building in dry storage. For such an event, very little contamination would occur beyond the site boundary (controlled area), even under the worst weather conditions (see Table 4-37 of the EIS). The accident analysis considered dispersion of radioactive materials to a distance of 80 kilometers (50 miles). However, as listed in Table 4-37, the total exposure to the population within this distance would be very low.

**7.4 (3733)**
**Comment** - EIS001160 / 0122
[Section 4.1.7] does not appear to consider off-site exposure potential associated with volcanism. Although volcanism is a low probability event, it would have a potentially high degree of consequence. The health risk associated with a low probability volcanism event should be estimated so as to determine whether some manner of related mitigation is warranted.

**Response**
Section 4.1.7 of the EIS discusses the potential occupational and public health and safety impacts associated with short-term (prior to the completion of repository closure) impacts. The events considered are limited to those with an annual probability of 1 chance in 10 million or greater. A volcanic event at Yucca Mountain is estimated to have a lower annual probability (approximately 1 chance in 70 million). However, Section 5.7.2 of the EIS discusses the possibility of volcanic disruption of a Yucca Mountain Repository. This analysis presents the long-term (postclosure) estimated annual risk from potential volcanic activity and has been updated from the analysis in the Draft EIS. The peak annual risk is estimated to be a small fraction of the individual protection standard for annual dose to a member of the public [15 millirem in Environmental Protection Agency regulations at 40 CFR 197.20 and Nuclear Regulatory Commission regulations at 10 CFR 63.102(j)].

**7.4 (3755)**
**Comment** - EIS001029 / 0003
Transportation and disposition of radioactive materials will take at least 30 years. What happens if an earthquake occurs before the wastes are completely buried underground? There may be aftershocks and other earthquakes following the first. Is there a contingency plan? Could one even work? How many systems such as communication, transportation, computers, must work properly? How many people must be involved? How much of the surface area would be damaged around Yucca Mountain.

**Response**
DOE would design repository surface and subsurface facilities to withstand a very severe earthquake with no substantial damage. The EIS analysis estimates that a major earthquake sufficient to destroy the Waste Handling Building, beyond the design basis required by the Nuclear Regulatory Commission, would have a probability of 1 in 50,000 per year. Appendix H of the EIS evaluates the potential impacts of such a major earthquake during repository operations. If it occurred, the analysis assumes that this event would cause a complete collapse of the Waste Handling Building and damage to fuel assemblies that would be out of the storage pools in the building during normal operations. The damage to the assemblies and the building would result in a release of radioactive material.

Conservatively assuming no evacuation of the public following the event and that exposure to the public from material deposited on the ground and consumed in food crops would continue with no intervention, the EIS lists potential consequences in Tables 4-36 and 4-37. Based on these consequences, DOE anticipates no adverse health effects to the public.

Even though the analysis identified no scenarios that would result in health effects to the public, DOE would put emergency plans in place that the Nuclear Regulatory Commission would have to approve before the repository

could meet licensing requirements. Periodic emergency drills graded by the Commission would ensure appropriate preparedness and that DOE would take appropriate actions if such an unlikely event occurred.

**7.4 (3812)**
**Comment** - EIS001325 / 0003
Another downside is that all the waste is in one single area and if something goes wrong, everything there will be ruined and the people there could be hurt.

**Response**
The EIS evaluates a full range of credible accidents from high probability/low consequence to low probability/high consequence. Credible accident scenarios (those having an annual probability of 1 chance in 10 million or higher) at a repository operations facility at Yucca Mountain are discussed in Section 4.1.8 of the EIS and summarized in Tables 4-36 and 4-37. Accidents involving transportation of the shipping casks, which would contain only solid materials, are evaluated in Section 6.2.4.

**7.4 (4039)**
**Comment** - EIS001513 / 0002
The risks and hazards of transport and disposal are dangerously high. The consequences of an accident are deadly. The minor consequences include cancer and sterility. The risks are also long lasting. The waste will remain radioactive and hazardous to human health and the environment for over 10,000 years. There are so many different situations involved, including transport and the transfer at Yucca Mountain into temporary or permanent storage. If Yucca Mountain is deemed unacceptable, there could also be transport out of Yucca Mountain. Many things could happen, such as highway accidents, terrorism, or earthquake. Are we prepared to deal with the effects of these events? Millions of people could be affected by these accidents.

**Response**
The EIS considers all the events mentioned in the comment [highway accidents, terrorism (sabotage), and earthquakes] and evaluates impacts from such events. Appendixes H and J evaluate repository and transportation accidents, respectively.

**7.4 (4289)**
**Comment** - EIS001160 / 0097
Page 4-60, Paragraph 2 of Section 4.1.8, Accident Scenario Impacts, states, "The impacts to offsite individuals from repository accidents would be small etc..." This statement appears unsubstantiated in as much as no appendices are listed where the reader can obtain the underlying data used to compute dosages and confirm or dispute the conclusions. The 0.013 rem threshold seems very small as it is significantly less that background radiation levels (background radiation levels as much as 0.15 rem, Source Book on Atomic Energy, Glasstone et al, 18.38 pp 745) and would be difficult to determine or quantify. The bounded worse case scenario for the noninvolved worker seems extremely low at 31 rem given nature of material being handled. Perhaps the drafters of the DEIS here assume safety measures for containment that are not otherwise described within the DEIS. Again this statement should reference the data used to compute it and what bounding criteria was utilized.

**Response**
Appendix H of the EIS describes the analytical methods and associated assumptions DOE used to calculate doses to offsite individuals, as indicated in Section 4.1.8.1. The maximum estimated doses listed in Tables 4-36 and 4-37 conservatively do not assume the implementation of safety measures after the accident occurred. If a real event occurred, appropriate safety and emergency response would occur. The noninvolved worker doses would be limited by the small amount of material available for release. Release fractions would be very small because large energy sources necessary to fragment and disperse significant amounts of the radioactive material would not be available.

**7.4 (4292)**
**Comment** - EIS001160 / 0100
Page 5-6: The sequence of events described in the first paragraph of Section 5.2 should also include volcanism and human intrusion as initiating events.

Page 5-16: The third paragraph of this page should also consider nuclear materials brought to the surface as a result of drilling.

**Response**
The text cited in the first comment discusses groundwater pathways as being "the primary means for the radioactive and chemically toxic materials to contact the biosphere." Sections 5.7.1 and 5.7.2 of the EIS discuss the suggested topics.

Section 5.7.1 also discusses drilling intrusions as a potential disruptive event. In the first paragraph of that section, DOE analyzed only the long-term doses associated with such an event based on a National Academy of Sciences recommendation that the long-term repository performance assessment not consider direct impacts of human intrusion. The last two sentences of the section address potential impacts to the drilling crew if activities associated with drilling through a waste package carried contaminated drilling mud to the surface. The text concludes, "The exposure to the drilling crew probably would result in lethal doses to those workers."

**7.4 (4515)**
**Comment** - EIS001410 / 0004
If all the nuclear waste reaches the site safely, the issue of long term storage remains. The government's construction plans are incomplete and unsafe. The government calls for nuclear waste disposal to begin prior to the completion of the site. However, Section 4.1.8.1 does not consider accidents that may occur during the construction phase, and cannot draw applicable conclusions because it uses conceptual models and "final facility design details are not available." The possibility of an incident due to a construction mishap must be taken into account in any complete safety analysis.

**Response**
As described in Section 2.1.2.2.1 of the EIS, underground construction on the development side of the repository would continue during the transfer of waste packages to the drifts on the emplacement side. The underground waste emplacement activities would be isolated from the construction activities, as described in Section H.2.1.3. The underground facility would be completed in phases. A thorough commissioning process would be employed before the newly constructed tunnels were appended to the repository. The isolation barriers would be moved to maintain the separations. Therefore, construction accidents would not affect the waste packages. Appendix F describes potential impacts to workers from construction accidents. DOE has updated Chapter 2, Chapter 4, and Appendix F to recognize the possibility of surface dry storage of waste concurrent with emplacement activities.

**7.4 (5772)**
**Comment** - EIS001887 / 0374
APPENDIX H. POTENTIAL REPOSITORY ACCIDENT SCENARIOS: ANALYTICAL METHODS AND RESULTS

In the Draft EIS, DOE analyzes the likelihood and consequences of potential air crashes at the repository. The formula used to estimate crash frequency is standard. Primary factors that must be taken into account is the crash rate for small aircraft (F-15, F-16) and the effective area of the target. The crash rate for small aircraft (page H-11) is provided by the Air Force and is standard; it is the long-term crash rate rather than the crash rate from the last 5 or 10 years.

The effective target area is greatly underestimated. It assumes a major accident would only affect the roof of the Waste Handling Building, since the walls of the Waste Handling Building are five feet thick. The analysis also assumes a jet engine will not penetrate a shipping cask. This is discussed further in Appendix H. Thus, the rail yard is not considered an area that is subject to radiological consequences. Conclusions regarding the consequences of a jet crash into a rail cask are based on assumptions about the air speed of an F-15 and the cross-section of a jet engine. The penetration depth is inversely proportional to the diameter of the penetrating object.

If the object impacting the facility is not a jet engine but a hanging bomb, this assertion by DOE can be disputed. Since Nellis is a bombing range, one must consider hanging bombs, either armed or dummy. Dummies weigh one ton, are made of concrete, and are conical-shaped. They could easily penetrate a cask at speeds of 500 fps. For example, inert bombs were used in Iraq to penetrate fortified bunkers, without "collateral damage." In addition, we

do not know whether Cruise missiles are flown at Nellis. For these reasons, the entire Waste Handling Building and repository freight yard, which would have a large number of shipping casks awaiting processing, must be included in the effective target area, Aeff. This dramatically alters the likelihood of an air crash accident.

According to DOE, the effective roof area of the Waste Handling Building is 27,000 $m^2$, whereas the rail yard plus Waste Handling Building is 0.6 $km^2$. (Fig. 2-11) Just considering the footprint, the probability of an air crash increases by a factor of 22, from $5.6 \times 10^{-8}$/y to $1.2 \times 10^{-6}$/y. If one expands the effective area to include the skid zone and the height of horizontal casks on rail cars, the effective area and probability would increase further. Since the probability is greater than $10^{-6}$, under DOE regulations, the rail yard must be redesigned to bring the probability down to $10^{-6}$/yr.

Potential source terms

The EIS considers a "typical" Pressurized Water Reactor (PWR) assembly as one that has cooled for 25.9 years. (page H-17) The State believes this could be an underestimate. However, even if one accepts this average age of 25.9 years, it is quite likely that fuels cooled both less than and more than 25 years would be transported to the proposed repository. Therefore, the accident consequences would be greater than estimated by DOE simply because radionuclides decay exponentially. Co-60, one of the bad actors, since it is located on the outside of fuel cladding, has a half-life of 5.25 years and decays exponentially. The EIS states that the average age of shipped fuel is used for estimates of Co-60 crud. (page H-19).

Consider the following scenario. PFS, a proposed private nuclear waste storage facility in Utah, operates until the repository begins operation (supposedly the year 2010) with much of the older spent fuel in the U.S. being shipped first to PFS or being stored at reactor sites in storage casks. For reactors still operating in the year 2010, it is likely that more recent spent fuel would be shipped directly to the repository. The entire cost of loading and shipping this fresher fuel would be borne by DOE, whereas for fuel already stored in casks, costs are already sunk and the incremental cost to the utility is small. Thus, contrary to DOE's view that oldest fuel will be shipped first, it is more likely that older fuel would first be shipped to PFS and newer fuel would be shipped first to the proposed repository, followed at a later time by very old spent fuel. In the end, the average age of fuel shipped might be 25.9 years, but in terms of accident impacts, one cannot take the average age of fuel, since it is not a linear, but exponential, decay.

As an example of the inherent error in considering only the characteristics of an "average age" fuel shipment, consider a dichotomous distribution of fuel ages, with ½ of the spent fuel being shipped after cooling for five years (the minimum cooling time required by law) and the other half being shipped after cooling for forty-seven years (perhaps cooling at the PFS facility while the newer fuel is shipped to the geologic repository). The average age of the spent fuel shipments is twenty-six years. If we assume there were two curies of Co-60 initially in the spent fuel, we obtain the following estimates for activity using: (1) only the average age of the fuel shipments (26 years); and (2) five years of decay for one curie of Co-60 and forty-seven years of decay for 1 curie of Co-60.

(1): half-life = 5.25 years
decay coefficient = $\ln(2)/5.25 = .13203$ $years^{-1}$
$[Co\text{-}60]_{t=26\ years} = (2\ Curies)e^{-.13203x26} = .065\ Curies$

(2): $[Co\text{-}60] = [Co\text{-}60]_{=5\ years} + [Co\text{-}60]_{t=47\ years}$
$[Co\text{-}60]_{t=5\ years} = (1\ Curie)e^{-.13203x5} = .517\ Curies$
$[Co\text{-}60]_{t=47\ years}\ (1\ Curie)e^{-.13203x47} = .002\ Curies$
$[Co\text{-}60] = .517 + .002 = .519\ Curies$

This simple calculation shows that using only the "average" fuel characteristics results in a gross underestimate of the impact of this short-lived radionuclide. Under the scenario involving PFS operation, waste characteristics will likely conform more to the dichotomous distribution used above than to a normal distribution. This leads to underestimates of the impacts of releases from these containers.

**Response**
The second paragraph of the comment disputes the target area assumed for the Waste Handling Building. Based on a change in design for the Waste Handling Building and refinements to the aircraft crash model, DOE has revised

the analysis of the aircraft crash into the vulnerable portions of the Waste Handling Building and determined it to be an incredible event. This result includes the assumption that both the walls and ceiling of the Waste Handling Building would be included in the impact area. The Waste Handling Building has been decreased in size based on the decision to reduce the number of transfer lines from five to three. Details of this analysis are included in Section H.2.1.3 of the EIS.

The third paragraph of the comment relates to the potential for hanging bombs, either armed or dummy, to penetrate the Waste Handling Building and transportation casks in the freight yard. DOE has determined that the dummy bombs (which are carried on only 10 percent of the flights out of Nellis) would not penetrate transportation casks at impact speeds up to 550 kilometers per hour (500 feet per second). (As mentioned previously, DOE evaluated aircraft crashes onto the Waste Handling Building and found them to not be credible). This assessment is based on the steel penetrating formula in *DOE Standard, Accident Analysis for Aircraft Crash into Hazardous Facilities* (DIRS 101810-DOE 1996). Using the dummy bomb weight and diameter [910 kilograms (2,000 pounds) and 0.49 meter (1.6 feet)], the formula calculated that the bomb would penetrate up to 0.89 meter (2.9 feet) of concrete or 7.6 centimeters (3 inches) of steel. Because the shipping cask walls would be made of steel more than or 7.6 centimeters thick, penetration would be unlikely to occur. Further, because only 10 percent of the flights carry such bombs, the event is below the credible level of 1 chance in 10 million. DOE has determined that Cruise missiles are not currently flown out of Nellis Air Force Base.

During normal operations, shipping casks that arrive at the repository would be moved either to a dry surface aging area or into the Waste Handling Building. Although surface aging was not evaluated in the Draft EIS, the potential consequences of aircraft crash into dry storage facilities were evaluated for the No-Action Alternative (Section 7.2.1.8) and for the repository retrieval scenario (Section 4.2.1.2.8). In both cases, penetration potential of above-ground storage facilities by aircraft components was determined not to be sufficient to breach the containers. The EIS has been updated to specifically address the potential consequences of an aircraft crash into surface aging facilities (see Appendix H, Section H.2.1.3). The analysis results continue to show that no breach of waste containers or release of radioactive materials would occur. Although an aircraft crash into the Waste Handling Building was found to be not credible, DOE decided to evaluate the impacts of such an event due to the potential for large impacts. The results are provided in Section H.2.1.5.1 of the EIS.

The second part of the comment deals with the characteristics of the fuel that DOE used to analyze accidents at the repository. DOE agrees that the fuel characteristics used in the Draft EIS needs to be revised to account for what is currently expected to be the shipping campaign for commercial spent nuclear fuel and also to account for the potential hazard of the fuel. DOE has reevaluated the appropriate characteristics to use for representative fuel involved in accidents and the results are given in the Final EIS, along with revised impacts associated with accidents involving the representative fuel.

**7.4 (5877)**
**Comment** - 010253 / 0002
Such a large concentration of waste in one place. 11,000 to 17,000 waste packages containing about 70,000 metric tons of uranium and plutonium--magnifies the risk of calamity from natural or human causes even what might be a small and manageable misfortune can become a colossal tragedy when this much radioactivity is in one place.

**Response**
Accidents during repository operations involving the handling of all the waste are examined in Appendix H. Long term performance of the repository, including the effects of natural and human-caused events on the waste package inventory, is evaluated in Chapter 5.

**7.4 (6399)**
**Comment** - EIS001605 / 0003
I wonder what the environmental impact statement says to the issue of safety in the depository itself. I would wonder what the environmental impact statement says on the issue of criticality. How are you going to monitor the site for criticality in the event that, and how are you going to deal with criticality if the issue arises?

Can this create an explosion? And can this create a disastrous situation of radioactive leaks into the environment?

**Response**
Appendix H of the EIS examines repository safety by evaluating a spectrum of credible radiological accidents and estimating their impacts. Design criteria, codes and standards, and operational controls would be incorporated to prevent criticality. A criticality could occur only if there were multiple failures of highly reliable controls. Sections H.2.1.1 and 5.8 specifically address the issue of criticality for repository operations and after repository closure, respectively. In both cases, the analysis concluded that criticality accidents would be extremely unlikely and, if they occurred, the impacts would not be significant. In Section 5.8 of the EIS, the potential for an explosive criticality was considered and found to be not credible.

**7.4 (6587)**
**Comment** - EIS001380 / 0012
On page H-28 there is a ridiculous assumption in the second paragraph that if a cask were breached, a worker would within 10 seconds "immediately vacate the area after observing that the cask had ruptured" implies cask rupture "out of the blue." While possible, it seems much more likely that cask breaching will be more likely to occur during a major accident in which it seems likely, or certainly possible, the worker will also be injured and not be able to escape to safety immediately. In this scenario, safety may be a long way away! Again, such simplistic assumptions cast doubt on the seriousness and medical competence of the people who prepared this draft document. I feel compelled to use such language because the assumptions insult my intelligence and this is very serious business indeed.

**Response**
Based on updated analyses (DIRS 150276-CRWMS M&O 2000; DIRS 152476-Sprung et al. 2000), the potential for the breach of a transportation cask during repository operations is not a credible scenario. The EIS has been revised to reflect this analysis and provide details for this conclusion. Therefore, DOE no longer considers this accident scenario as a credible event (a probability of greater than 1 chance in 10 million per year).

**7.4 (6589)**
**Comment** - EIS001380 / 0013
Page H-31. I challenge the statement that 3,500 drums of solid hazardous wastes and 1,700 gallons of hazardous liquid waste "would pose a very small potential for accidental releases and exposures of workers" defies common sense. These barrels in time all leak, so I would say the potential is almost 100% that some leakage will occur and therefore the risk is proportional to how many barrels degrade how quickly and what they contain. There is a lot of data on these points at Superfund and FUSRAP sites, so why not be more specific and include some meaningful data here. Because these barrels might leak into the Yucca Mountain aquifer, the public and workers and soldiers at Nellis would be at significant risk.

**Response**
Section H.2.1.2 of the EIS discusses how DOE would generate low-level radioactive waste during the repository construction, emplacement, operations, maintenance, and closure phases of the project. Section H.2.1.2 also discusses that during this time the Department would accumulate the waste in accordance with regulations of the Resource Conservation and Recovery Act. Hazardous wastes would be shipped off the site for treatment and disposal to appropriately permitted facilities. The actual amount of waste on the site at one time would be small and DOE would exercise appropriate controls during waste generation, accumulation, packaging, and shipment. The potential for accidents and impacts would be small.

The comparison to Superfund and Formerly Utilized Sites Remedial Action Program (FUSRAP) sites is not appropriate. Superfund and FUSRAP sites are sites where disposal or long term inappropriate storage of wastes has occurred. Low-level radioactive or chemical hazardous wastes would not be stored long term or disposed of at Yucca Mountain.

**7.4 (6757)**
**Comment** - EIS001522 / 0006
Consider several examples of this logically-invalid, question-begging character of the DOE's analysis. When the DOE says, for instance, that "Sixteen accident scenarios…bound the consequences of credible accidents at the repository" (DEIS, 1999, 4-61), this claim begs the question because it presupposes, ahead of time, what accidents are credible, and then after this presupposition, concludes that the accidents will be minor. DOE begs the whole

question of the accidents that Yucca Mountain would be likely to cause because it sets up the problem in a question-begging way. It prescribes what accidents are "reasonably foreseeable" (DEIS, 1999, 6-41), despite the fact that it is impossible to predict human error, especially so far into the future, as the National Academy noted (NRC, 1995). After assessing only these question-begging accidents, the DOE then concludes that the risks are small. The "reasonably foreseeable" accidents that the DOE proposes, however, are quite different from those that the State of Nevada, where most such accidents would occur, alleges. Thus there are strong grounds for believing not only that DOE has "stacked the deck" in the material it considers, but also that its resultant conclusions are little more than begging the question.

**Response**
Appendix H of the EIS describes the methodology for selecting accidents for analysis and the impacts from such accidents and provides references to detailed supporting analyses. The analyses are based on well-founded methods of system safety analysis accepted by DOE and the Nuclear Regulatory Commission. The maximum credible accident would be a complete collapse of the Waste Handling Building during a severe seismic event that would be beyond the design basis of the building, with an estimated probability of 1 in 50,000 years. The analysis assumed that the collapse of the building would damage fuel assemblies in dry storage in the building. DOE included human error in the accident probabilities by accounting for such errors in the accident sequences analyzed in Appendix H.

**7.4 (6930)**
**Comment** - EIS001804 / 0003
Let me go back to my talk here. Every other storage system has been found to have major flaws. New answer follows new answer and we're back to burying atomic waste in a deep hole in the ground such as Russia did in the Kyzytkum Ural Mountains that reached critical mass in 1958 and exploded and contaminated hundreds of square miles. Nobody brought that up. Maybe they're not that old, but that's what happened in Russia and this is documented.

**Response**
DOE has stored high-level radioactive materials, including spent nuclear fuel, at several sites in the United States for several decades without significant release of radioactive material. Commercial utilities have stored spent nuclear fuel at generating sites for several decades without a significant release of radioactive material. Section H.2.1.1 of the EIS discusses criticality potential during repository operations. Section 5.8 discusses potential postclosure criticality. In both cases, the conclusion is that criticality accidents would be extremely unlikely and, if they occurred, impacts would be minor.

There have been a number of criticality accidents in Russia since 1953 resulting in a total of seven worker deaths (no deaths to members of the public). However, none of these involved handling or burial of radioactive waste. The commenter is apparently referring to a September 29, 1957, event that was not a criticality accident but a chemical explosion involving a radioactive liquid waste storage tank. The event occurred at the Mayak Chemical Complex near Kyshtym, Russia in the Ural Mountains. This event resulted in a large release of radioactive material and extensive land contamination. The waste tank that exploded was not in a geologic repository, but was one of 16 similar tanks placed in a concrete trench with a 10-inch concrete cover. The tanks contained high-level liquid waste. In the tank that exploded, explosive nitrate salts and acetate had dried and concentrated on the surface of the waste and eventually detonated. There are no liquid radioactive wastes or explosive chemicals allowed for disposal at the proposed Yucca Mountain Repository. Therefore, events similar to this one are not possible at Yucca Mountain and this event is not relevant to the safety or environmental impact analysis of the proposed repository.

**7.4 (7266)**
**Comment** - EIS001832 / 0014
In its analysis of radiological consequences for repository operations accident scenarios, DOE again considers accidents with probabilities of 1 in 10 million, thereby increasing the calculated worker and public health effects associated with such an accident above and beyond what is credible.

If DOE believes it is required to leave analyses in the FEIS that consider 1 in 10 million events, the FEIS should, at a minimum, also describe the effects at higher, more realistic probabilities.

**Response**
It is true that DOE considers accidents with a frequency of 1 in 10 million or greater per year to be credible. This belief is based on a conservative interpretation of the National Environmental Policy Act, which requires consideration of "reasonably foreseeable" events. In addition, the EIS examines more probable accidents, with the highest probability being greater than once in 2 years. Appendix H discusses the impacts of all accidents, and their probability estimates.

**7.4 (7561)**
**Comment** - EIS001912 / 0066
Table 4-35 what does the information in this table mean? Are the results adverse?

**Response**
Table 4-36 (previously 4-35) of the EIS presents the potential range of credible accidents (annual probability of 1 chance in 10 million or greater) that could occur at a repository operations facility. This table also presents potential radiation dose and impacts from such events to the maximally exposed offsite individual, the population surrounding the repository, and to repository workers. The most severe credible accident is estimated to initiate because an earthquake beyond the facility design basis (an annual probability of 1 chance in 55,000) occurred and caused the Waste Handling Building to collapse. The impacts from this accident are evaluated in Section H.2.1.5.

**7.4 (7610)**
**Comment** - EIS002027 / 0001
I am worried about all the nuclear waste going to be stored in Yucca Mountain. The reason why I am worried is what about the possibility of a big spill of nuclear waste. I have seen records of the test done on the casks but nothing is impossible.

**Response**
No liquids would be shipped to Yucca Mountain for disposal, so liquid spills of waste would not be possible. It would be possible for small amounts of solid radioactive materials to be released in a serious accident.

The EIS evaluates a full range of credible accidents from high probability/low consequence to low probability/high consequence. Credible accident scenarios (those having an annual probability of 1 chance in 10 million or higher) at a repository operations facility at Yucca Mountain are discussed in Section 4.1.8 and summarized in Tables 4-36 and 4-37. Accidents involving transportation of the shipping casks, which would contain only solid materials, are evaluated in Chapter 6.

**7.4 (8365)**
**Comment** - EIS001873 / 0049
P. 4-63. DOE assumes that a seriously injured worker would not be concerned about radiation exposure. That does not make sense. DOE should show the radiation consequences to involved workers under scenarios 13-15.

**Response**
The accidents listed in Table 4-36 of the EIS would involve extensive physical damage, and a worker in the immediate vicinity would be likely to experience serious injury or death. The health impacts of radiation exposure for involved workers, which would include only momentary exposure from inhalation and immersion in a radioactive cloud (with no ingestion of radioactive material), would be minimal in comparison to the physical trauma.

**7.4 (8587)**
**Comment** - EIS000817 / 0187
P. H-19. I've always been interested in CRUD. It hasn't received enough study at all. As it says here "there are very few data for the accident of interest" and "the physical condition of crud can be highly variable" -- and I may add can cause lots of problems if it falls off the cladding! It could jam in the basket sleeves preventing removal of the assemblies. It could fall to the bottom of the cask. It could cloud pool water and clog water filters. It could pollute the air in unloading. It could reveal pits and cracks when it falls off or is scraped off when dry. What else?

**Response**
Crud deposits on fuel rods have been measured (DIRS 152476-Sprung et al. 2000) and determined to be agglomerates, rather than solid films, comprised of irregularly shaped particles with diameters ranging from (0.000001 to 0.0001 millimeter) (0.000004 to 0.0004 inch), compared to a fuel rod cladding thickness of about 0.025 inches for typical pressurized-water reactor fuel. Thus, crud particles would be very small and would be unlikely to jam in the basket sleeves preventing assembly removal. The pool water would be continuously circulated through filters, which would remove the particles. The filters would be replaced when they became loaded with particulate material. Any crud particles released during unloading would be confined to the Waste Handling Building and would be filtered out of the air by the ventilation system. Crud releases for accidents that were not confined by the Waste Handling Building are considered in dose calculations.

**7.4 (8592)**
**Comment** - EIS000817 / 0188
P. H-20 Fuel Rod Gaps -- Tritium and krypton, etc. -- when the pressure in the rod is released and gases go out, I predict more problems that we are considering now. Airborne particulates could be a real problem. You say, "No specific reference could be found to the volatile materials in the gap." Why not? Do some tests then.

**Response**
The statement referred to in this comment ("no specific reference could be found to the volatile materials in the gap") refers to information regarding the amount of respirable particles in the gap. Absent specific information on the amount of respirable particles, DOE made a conservative assumption (for the purposes of analysis) that all the particulate material in the gap would be respirable. This assumption is discussed later in Section H.2.1.4.1.2 of the EIS.

**7.4 (8593)**
**Comment** - EIS000817 / 0189
P. H-21. I'm confused, I thought 21 was the number, but on p. H-5 you said 4.

**Response**
Both values are correct. The value of 21 assemblies refers to the maximum number of pressurized-water reactor assemblies in a fully loaded waste package. The value of four assemblies refers to the maximum number of pressurized-water reactor assemblies that can be loaded into a transfer basket, which is used for waste package loading operations within the Waste Handling Building.

**7.4 (8595)**
**Comment** - EIS000817 / 0190
P. H-31. Be careful here -- I doubt it's as easy at that. -- Retrieval is not just "essentially the reverse of waste package emplacement." Think this through in detail. How will it really work? And maybe you will have to open some packages for an unexpected reason. Accidents may be very different.

**Response**
The concept of retrieval being the reverse of emplacement refers only to subsurface operations. Subsurface retrieval operations are expected to involve the same equipment and the same routing as emplacement. A description of potential retrieval activities, and associated impacts are described in Section 4.2 of this EIS. Surface operations would be somewhat different, as described in Section H.3. The most conservative accident would be the transporter runaway event analyzed in the Draft EIS in which a waste package failed and released airborne radioactive material.

**7.4 (8834)**
**Comment** - EIS000869 / 0011
The highest radiation risk to the public is stated as being caused by Radon-222. There has never been, in the history of mankind, so much radioactive material in one site as is proposed for Yucca Mountain. We have seen what happened at Three Mile Island in 1979, Chernobyl in 1986, and just recently in Japan with markedly lower amounts of radioactive material. The numbers quoted for an accident in S.4.1.9, paragraph two, are optimistic at best. Paragraph three sums up this issue. "In any event, because of the large quantities of radioactive material, radiological considerations would outweigh nonradiological concerns under most accident conditions."

**Response**
Naturally occurring radon-222 and its decay products released in ventilation exhaust would be the main contributors to public radiological risk from routine operations at the repository, as discussed in Section 4.1.2, with results summarized in Section 4.1.7 of the EIS. Hypothetical accidents at the repository, discussed in Section 4.1.8, could result in releases of radionuclides from the spent nuclear fuel assemblies. The radionuclides that could contribute to dose (and radiological risk) from accidents include such radionuclides as cobalt-60, strontium-90, and cesium-137. Appendix H of the EIS contains additional information.

Both the Three Mile Island and the Tokaimura (Japan) accidents resulted in no health impacts to members of the public. The Chernobyl accident was a much different case, which illustrates some of the important considerations in evaluating hypothetical accidents. The quantity of radioactive material, as mentioned by the commenter, is just one of the factors that must be considered. Three other very important factors are:

- The availability of a source of energy to cause a release and transport of radioactive material
- The fraction of the radionuclide inventory released, which would depend on the physical form (that is, solid, powder, liquid, gas)
- The specific radionuclides involved in the release

At the end of the emplacement period, the proposed Yucca Mountain Repository would have a very large inventory of radioactive material. However, during spent nuclear fuel handling operations only relatively small quantities of fuel would be handled at one time, limiting the quantity that could be involved in a handling accident. Once emplaced, the radioactive material inventory would be isolated from most external energy sources (a very low probability volcanic event would be an exception) that could cause a release and there would not be a high-energy source to drive a release as there was at Chernobyl. Furthermore, nearly all of the material to be emplaced at Yucca Mountain would be in a bulk solid form, making the potential for release much smaller than such physical forms as liquid, gas, or powder. Other important factors in evaluating accidents are the types of radionuclides present (not just the quantity), atmospheric transport and dispersion, and exposure pathways (all of which would affect both the radiation dose that could be received and the potential radiological risk). For example, all of the radioactive material emplaced at the repository would have been aged at least several years, limiting the quantity of short-lived, highly radioactive nuclides that could produce significant health detriments. When all these factors are taken into consideration, the radiological risk of accidents at the Yucca Mountain Repository would be small, as presented in Section 4.1.8 and Appendix H of the EIS.

**7.4 (9086)**
**Comment** - 010151 / 0004
The blending thing blows my mind. We have a DOE facility near us called the Savannah River Site, which rivals Hanford in Washington as the most contaminated place on earth.

And this blending thing, you know, DOE is not famous for its accounting ability. And so they could screw up. They think they got a cool thing and a hot thing, but they got two hot things and you've got a criticality. It's risky.

**Response**
A misload event involving excessive hot fuel assemblies would not cause a criticality. Hot fuel assemblies are those that have higher heating rates due to shorter aging times. They do not contain more fissile material than colder assemblies. Further, a moderator (water) must be present to cause a criticality. No water would be present in or around the waste packages during the loading, transportation, and emplacement of the waste, and blending and storage pools containing water would be designed so that criticality would not be a credible event. Utilities with commercial nuclear powerplants licensed by the Nuclear Regulatory Commission have a history of safe storage-pool operations. Storage and blending facilities at the proposed repository also would be licensed by the Nuclear Regulatory Commission.

**7.4 (9219)**
**Comment** - 010294 / 0003
No design basis given for differential ground displacement from one of the faults going through the underground repository. Provide accident analysis for this Design Basis Accident, where a major tunnel was damaged.

**Response**
No active faults would intersect the emplacement drifts, so differential ground displacement from an earthquake would be unlikely. The effects of seismic disturbances, including the possibility of a new fault displacement intersecting the repository, are evaluated in *Preclosure Design Basis Events Related to Waste Packages* (DIRS 150198-CRWMS M&O 2000). The evaluation concluded that such events are not credible.

**7.4 (9710)**
**Comment** - EIS002154 / 0007
The people in Congress should realize what they're doing to this state, what they're doing to this area. If they have one nuclear accident, something leak through under those casings and explodes, Las Vegas will be wiped off the map. Boulder, Hoover Dam won't be here anymore and half of California will be in the Pacific Ocean at the San Andreas Fault. That's the possibility and the probability if you don't disperse this stuff, and don't park it at one place. It's high-level nuclear material and will devastate the whole area.

**Response**
If the proposed repository became operational, DOE would place the waste containers in emplacement drifts that would be separated by several hundred feet of rock. The material in the containers could not explode, even if it leaked from the containers and accumulated. DOE examined the potential for explosions from repository operations and found it to be noncredible, as indicated in the material referenced in Appendix H of the EIS. No liquids or explosive materials would be shipped to the proposed repository.

**7.4 (9850)**
**Comment** - EIS001888 / 0414
[Clark County summary of a comment it received from a member of the public.]

One commenter requested that the EIS indicate whether all lands would be cleaned up to the same standards after an accident, regardless of ownership.

**Response**
DOE is confident that operation of the proposed Yucca Mountain Repository and transportation of spent nuclear fuel and high-level radioactive waste to the repository could be accomplished without serious accidents or radionuclide releases that would lead to contamination of nearby land. In the unlikely event that a release of radionuclides occurred and land was contaminated, it is possible that different standards for cleanup would be applied. For example, residential and agricultural land would likely be remediated to a higher standard (lower allowable level of remaining radionuclide concentration) than unoccupied or nonagricultural land. For some types of land, remediation could be more ecologically damaging than the radionuclide contamination. In such cases, public access and use of products could be restricted. There would probably be differences between publicly and privately owned land, and issues of private compensation would arise. Any such cases would have to be carefully evaluated for cost and risk implications. The EIS indicates in Section 4.1.8 that all lands would be cleaned up at the time of the accident to existing applicable standards.

**7.4 (9881)**
**Comment** - EIS001888 / 0427
[Clark County summary of comments it has received from the public.]

Commenters expressed the need for the repository EIS to evaluate events and processes, including those having low-probabilities of occurrence, but resulting in high consequences. Others requested the analysis of credible events and processes, and worst case events and processes (regardless of probability).

**Response**
Appendix H of the EIS presents impact estimates from both low-probability/high-consequence events and high-probability/low-consequence events. The worst-case accident would be a beyond-design-basis seismic event that would collapse the Waste Handling Building and damage fuel assemblies in dry storage. The EIS does not examine accidents that have a probability of less than 1 in 10 million per year. Such events are not credible based on DOE guidance on the implementation of the National Environmental Policy Act, which states that EISs should examine environmental impacts that are "reasonably foreseeable". Tables 4-36 and 4-37 list the results of the EIS analysis of

reasonably foreseeable accidents. DOE anticipates no adverse health effects to the public from any reasonably foreseeable repository accident.

**7.4 (10313)**
**Comment** - EIS002099 / 0004
They can build all these casks and all these things. What about all the accidents when they start emptying those casks and they have to transport shipment after shipment after shipment 30, 40, 70,000 times they have to take some kind of machine and pull this stuff out of these casks and transport it down into these tunnels. What about if there's a mistake. What about if there's an accident? Then you have all of this waste being traveled -- transporting through all these roads. One accident could cause environmental impact that could cause generations and generations of health problems for our people.

**Response**
Section 4.1.8 and Appendix H of the EIS discuss the potential for occurrence and impacts of these types of accidents. Section 2.1.2 presents a description of repository operations. Material to be disposed of in the repository could be removed from shipping casks, depending on the packaging option selected. Because this material would be solid metal spent nuclear fuel and vitrified or otherwise immobilized high-level radioactive waste with very little potential for dispersible material, the potential for release and human health impacts would be very low. Even for an earthquake that could affect all fuel assemblies in dry storage in the Waste Handling Building, the potential for a latent cancer fatality in the hypothetical maximally exposed individual within 80 kilometers (50 miles) of the repository would be very low (see Section H.2.1.5).

Sections 6.2 and 6.3 and Appendix J of the EIS discuss the potential for transportation accidents. While DOE acknowledges that transportation accidents would probably occur, the probability for an accident with release of radioactive material and exposure of the public would be very low, as discussed in Chapter 6.

With regard to impacts, the risk of a latent cancer fatality is the principal risk from exposure to ionizing radiation. The potential for other types of health effects is recognized, namely nonfatal cancer and hereditary disorders. The International Commission on Radiological Protection and National Council on Radiation Protection and Measurements state that the risk factors for nonfatal cancer and hereditary disorders are 20 percent and up to 26 percent, respectively, of the fatal cancer risk. Section F.1.1.5 of the EIS discusses the potential for these other effects. Because the risk of these stochastic, nonfatal effects would be less than one-half of the fatal cancer risk, DOE has chosen to present only the estimates of fatal cancer risk.

**7.4 (10399)**
**Comment** - EIS002192 / 0005
Now in the 1,600 pages of the EIS that I commented on, I said there's one line in there that really gets to me, and the DOE says if we have a flood, we are in big trouble, one line.

**Response**
Section H.2.1.3 of the EIS examines flooding. This section discusses the fact that although flash floods could occur in the vicinity of the repository, earlier assessments screened out severe weather events as potential accident-initiating events. The potential for dispersion of radioactive material in the event of a flood would be very limited. Therefore, DOE did not conduct detailed evaluations of impacts from flooding. Potential site flooding is discussed in Section 3.1.4.1.2 of the EIS.

**7.4 (10744)**
**Comment** - EIS002101 / 0006
You know, we're humans. We saw it over in Japan. Human beings make errors. You have not counted that factor into your DEIS and you need to factor that in way, way more. Take the note of that because I really appreciate that you would do that and think about it. I mean, for example, right here, there's like fifty people outside couldn't get into your room. Come on. You know, maybe that's scientific calculations as far as how many square inches a human being occupied took, but it's a factor. I'm not blaming you as a person. I'm saying humans make mistakes.

**Response**
As indicated in Section H.2 of the EIS, the evaluation of repository accidents considered human errors. Specifically, the estimates of accident sequence probabilities include contributions from human errors in both the initiating events (for example, handling operations) and the mitigating systems (for example, failure to stop a runaway waste package transporter). The documents referenced in Appendix H contain details of these evaluations.

**7.4 (10782)**
**Comment** - 010322 / 0004
Does placing the waste packages closer together create more of a hazard, a higher combustibility, and does it create more of a terrorist target? And that I didn't see at all evaluated in the Supplement, the idea of terrorism out at the mountain, and so I'm concerned about that.

**Response**
Waste package spacing does not influence the potential for combustion, criticality, or an enhanced target. None of the waste packages would contain combustible material. Further, the temperature of the waste packages would be monitored and maintained below limits that would create a potential for any release. The temperature of the waste packages would be controlled by ventilation, fuel assembly blending, and spacing. Acts of sabotage would be minimized by physical and administrative barriers that would prevent human access to the emplacement drifts. Potential acts of sabotage during operation are discussed in Section H.2.1.3 of the EIS. Criticality events would be precluded by the use of neutron absorbers, where necessary, in each storage package.

**7.4 (11023)**
**Comment** - EIS001896 / 0020
Section 4.1.8 [Repository Accidents]

The DEIS identifies the radiological results of the Maximum Reasonably Foreseeable Accident [MRFA], but does NOT identify what the actual MRFA is in the body of the DEIS. A detailed description of the MRFA is necessary for any reasonable planning effort. Furthermore, a description of other accident/ incidents that are less than the MRFA, but which affect and impact the emergency response system, are necessary.

**Response**
Section 4.1.8 of the EIS identifies the most severe credible accident scenario as an earthquake, and lists the consequences for such an event in Table 4-36. Appendix H provides a detailed description of this event. In addition, the EIS considers a number of other accidents that could produce smaller offsite consequences than this maximum event. Table 4-36 also provides consequences for these events and Appendix H provides detailed descriptions of the events. For all accidents analyzed, no emergency response activities were assumed to occur. DOE intends, however, to develop and implement emergency response plans prior to repository operations to mitigate impacts to the workers and to the public in the event of an accident.

**7.4 (11261)**
**Comment** - EIS001337 / 0123
Lincoln County and the City of Caliente also provided information during scoping which demonstrated given average wind speeds in the vicinity of Yucca Mountain of 7.4 miles per hour (mph) and peak recorded gusts of 60 mph, it is possible that airborne radioisotopes could be transported to the proximity of Lincoln County communities within 1.5 to 8 hours.* The City and County pointed out that the short airborne emission travel time is in part why DOE has previously declared portions of Lincoln County as within the "Off-site Uncontrollable Area" (OSUA). The County and City urged DOE to assess the potential for and related impacts of off-site exposures to residents and the economy of the County. The DEIS does not consider off-site exposure of communities within Lincoln County.

*U.S. Department of Energy, Draft Environmental Assessment: Yucca Mountain Site, Nevada Research and Development Area, Nevada, Office of Civilian Radioactive Waste Management, December 1984.

**Response**
The highest potential for impacts from accidental releases would be at locations closest to the release point, under conditions of very stable meteorology, which have very low wind speeds [typically 2 meters per second (about 4 miles per hour) or less] and stable atmospheric conditions such as inversions. The high wind speeds and concurrent

very unstable meteorological conditions mentioned by the commenter would result in lower health impacts but would spread contamination over a greater area during a potential accident. Section 4.1.8 and Appendix H of the EIS indicate that the potential for impacts to the maximally exposed individual and the population within 80 kilometers (50 miles) even under unfavorable accident conditions would be very low, with no radiation-related health impacts. Impacts to occupied portions of Lincoln County and the City of Caliente [about 190 kilometers (120 miles) distant] would be much lower. Therefore, repository accident evaluations do not include these locations.

**7.4 (11754)**
**Comment** - 010320 / 0003
Although the Science and Engineering Report discloses that normal events could occur at the surface aging facility and waste handling building, there is no discussion of the types of normal events, their probability of occurrence or the potential consequences to workers, the public or the environment. The DEIS needs to identify these possibly events and their consequences.

**Response**
Appendix H of the Final EIS provides an identification of accidental events and their impacts that could occur during repository operations.

**7.4 (11833)**
**Comment** - 010026 / 0003
And what about fuel blending? The process of mixing fuel assemblies of different temperatures to lower a waste package temperature has never been done before. Human error could have unknown consequences.

**Response**
Fuel assembly blending has been done in shipments and storage of commercial fuel at commercial power plants to maintain the casks within licensing parameters that restrict cask temperature and external dose rate. Accidents involving blending operations are evaluated and impacts presented in Appendix H of the EIS. The accident sequence probabilities include accidents initiated by human error.

**7.4 (12016)**
**Comment** - 010080 / 0002
The nuclear lobby would disagree because they know that the DOE pays little attention to plans for accidents, electrical or mechanical malfunctions at Yucca Mountain.

**Response**
The EIS evaluates impacts from a spectrum of potential accident scenarios, from minor events to highly improbable natural phenomena such as beyond-design-basis earthquakes (1 chance in 50,000 per year). Appendixes H and I of the EIS describe the results of these evaluations for repository operations (preclosure), and long-term impacts (postclosure), respectively.

While accidents and malfunctions were not discussed in the Supplement to the Draft EIS, other project documents do discuss them. See, for example, the *Yucca Mountain Science and Engineering Report* (DIRS 153849-DOE 2001), which discusses off-normal retrieval procedures and equipment. During the preclosure period, which could last more than 300 years, the repository would be open and subject to inspection and maintenance. Should problems with corrosion of rails, switches, etc., be detected, repairs or replacements would be made.

**7.4 (12203)**
**Comment** - EIS002263 / 0001
I noticed one thing in the presentation. There was 1.4 in ten million chance of an accident. I recall it was these same people that told us – I forget, how many, one in how many thousands reactor years that there will be an accident the size of Three-Mile-Island. And when Three-Mile-Island came along, why suddenly those statistics were no longer quoted.

I have a feeling that the estimate of their chances of accident is off by an equal amount. Part of the plan of the DOE places a lot of emphasis on the strength of their canisters. Canister strength is based on the crystalline structure of metals and possibly plastics. However, over a period of time, reactivity will destroy the strength of these metallic

crystals and also of plastics or whatever other materials is used to strengthen these canisters. Also, these canisters will not be monitored, as they cannot be, as the temperature in the tunnels will exceed 200 to possibly 400°. They will eventually rupture, and vast quantities of radioactivity will then fall through the fault in the mountain and into the aquifer before it is detected.

This would then immediately change the estimate of approximately two millirems at 40 kilometers, to something very substantially higher than this. Even though the aquifer flows mostly to the west from Yucca Mountain, the scenario of such a leakage could easily render Las Vegas uninhabitable within 50 to 100 years.

Downstream from Yucca Mountain is Amargosa Valley. There is a dairy there that ships 35,000 gallons of milk per day to Los Angeles market. If these canisters do leak and discharge their radioactivity into the aquifer, the water would very quickly be picked up and passed along in the milk to millions of people to Los Angeles. And I have not seen this issue addressed in the Environmental Impact Statement.

**Response**
The occurrence of a single event (such as the Three Mile Island accident) that has a low estimated probability of occurrence does not prove or disprove the validity of the probability estimate. The *Reactor Safety Study* (DIRS 107799-NRC 1975), which the Nuclear Regulatory Commission published in 1975, before the Three Mile Island event, estimated that the probability of a core melt accident would be about $1 \times 10^{-4}$ per reactor year, or 1 chance in 10,000 per year for a U.S. reactor. At present, worldwide commercial operating experience with the population of commercial nuclear reactors similar to the type operated in the United States totals at least 5,000 reactor-years. The Three Mile Island accident represents the only partial core melt accident in 5,000 reactor-years of experience, which is a frequency of $2 \times 10^{-4}$ such accidents per reactor year. Thus, the commercial nuclear reactor experience with one core melt accident is not inconsistent with an estimate of $1 \times 10^{-4}$ per reactor year. The Three Mile Island experience, which resulted in no significant radioactive release, was the driver for many changes to commercial nuclear reactor designs and operations that have reduced the probability of such events even further.

The EIS results for groundwater contamination are based on a probabilistic analysis in which much of the input data is in the form of a probability distribution of a range of values, and the outcome is a distribution of possible results. In the case of canister degradation, the analysis considered such factors as gamma-ray effects on the metals, high temperatures [which would never reach 204°C (400°F) by design], and adverse chemical environments. Waste package failure would occur slowly over thousands of years. The extreme case discussed in the comment would be reflected in the results as a high percentile occurrence, such as the 95th percentile that is reported. Even the most pessimistic end of this range estimates that most waste packages would last for thousands, not hundreds, of years. Furthermore, catastrophic failure of the waste packages would not be a credible event.

The groundwater under Yucca Mountain flows to the south toward Death Valley. There is no evidence that any of that groundwater reaches any area of high population such as Las Vegas or Pahrump (see Chapter 3 of the EIS). Thus, material that could eventually be released into the mountain from the waste packages would not flow to these population areas. Furthermore, groundwater travel times are so slow that it would take thousands of years after release from a waste package for the material to move to the nearest discharge point.

DOE has incorporated milk production and shipments from the Amargosa Valley dairy and the effect on milk consumption in the analysis in Chapter 5 of the Final EIS.

**7.4 (12332)**
**Comment** - 010165 / 0005
Also the radiological impacts under accidents at the surface facility, so accidents that happened on the surface facility. It seems to be limited to the general public, as I think the figures were quoted in terms of exposure to the public. And I was wondering where the workers figure in on that one. What would be the impacts on people that are actually working there? I didn't see that in the document either. Again, that's sort of a quick review.

**Response**
Section 4.1.8.1 of the EIS describes worker doses from accidents in the Waste Handling Building. Appendix H describes the analysis of repository accidents.

**7.4 (12568)**
**Comment** - 010174 / 0007
Yucca Mountain is in the 3rd most active earthquake zone in the United States. We believe the effects of possible earthquakes have not been adequately studied, in relation to causing seepage in the underground repository, disrupting the inventory pools, or disrupting the 200 acre above-ground storage facility for 4500 dry casks. In fact, there have been no site suitability studies for the above-ground storage facility.

**Response**
Earthquake effects in relation to causing seepage in the underground repository were screened out in the Total System Performance Assessment model due to low consequences. Accidents involving the spent nuclear fuel storage modules in the surface aging facility and the Waste Handling Building (which includes the fuel blending facility) are evaluated in Section H.2 of the Final EIS. These facilities would be designed and constructed to comply with all applicable Nuclear Regulatory Commission licensing requirements which include seismic design criteria specific to the repository.

**7.4 (12656)**
**Comment** - 010381 / 0010
The EIS lacks treatment of cumulative effects from both Yucca Mountain and the Nevada Test Site. Surface water from both these projects comes into the Amargosa Valley and beyond, all the way to Death Valley. The new design requires aboveground storage of large quantities of spent nuclear fuel in pools and in casks. This surface storage is being proposed to take place over a period of decades -- these facilities themselves are obviously a risk to surface water. There is a real possibility of earthquake damage to the site. Tecopa is considered Seismic Zone 3, and Yucca Mountain is considered potentially more active than Tecopa.

**Response**
Repository facilities would be designed to withstand the probable maximum flood. As discussed in Section H.2.1.3 of the EIS, flash floods, while unlikely, could occur in the vicinity of the proposed repository (DIRS 100204-CRWMS M&O 1996). However, an earlier assessment (DIRS 103237-CRWMS M&O 1998) screened out severe weather events as potential accident-initiating events primarily due to flood design criteria and by assumptions that operational rules would preclude transport and emplacement operations whenever there were local forecasts of severe weather. A quantitative analysis of flood events (DIRS 104699-Jackson et al. 1984) concluded that the only radioactive material that extreme flooding could disperse to the environment would be decontamination sludge from the waste treatment complex. The doses resulting from such dispersion would be limited to workers, and would be very small (DIRS 104699-Jackson et al. 1984). A more recent study reached a similar conclusion (DIRS 101930-Ma et al. 1992).

Less severe storm flooding events would not carry contaminated water into nearby rivers because the repository design would include a storm drainage control and collection system to contain water runoff and prevent spillage over the fill slopes. A retention pond would be built to prevent stormwater pollution. Further, there are no rivers in the vicinity of the proposed repository to transport contaminated water. Casks in the aging facility would not contain significant amounts of radioactive contamination on surfaces, and casks would be monitored for leakage and repaired if leakage was detected.

Because there would be only very small quantities of surface contamination on the storage modules or casks at the fuel aging facility, stormwater runoff would not represent a substantial source of radioactive contamination. Impacts from an accident initiated by a beyond-design-basis earthquake are reported in Appendix H of the EIS.

**7.4 (12842)**
**Comment** - 010307 / 0008
Nuclear fuel blending inventory pools, which would store up to 12,000 fuel assemblies are barely mentioned and there is only one limited diagram (Figure 2-5). There is no detail on the design, water source, water circulation and treatment, or safety features. One sentence in the Wastewater section (2.3.4.2 [2.3.2.4.2]) mentions the 10% increase in evaporation pools from this source.

**Response**
The level of discussion in the EIS is similar to the description of the other operational characteristics of the waste handling process. DOE based the analyses in the Draft EIS, Supplement to the Draft EIS, and Final EIS on the Viability Assessment, (DIRS 101779-DOE 1998), Science and Engineering Report (DIRS 153849-DOE 2001), and Preliminary Site Suitability Evaluation (DIRS 155734-DOE 2001), which provide more detailed engineering descriptions. See those documents and the other references for more detail about blending and other aspects of the design.

**7.4 (13088)**
**Comment** - 010227 / 0006
The SDEIS also does not talk about what could happen if the area of the waste ponds flood, or are damaged by earthquakes.

**Response**
The repository design does not include waste ponds, but does include stormwater retention ponds and evaporation ponds. The evaporation ponds are designed for nonhazardous and nonradioactive wastewaters. In the unlikely event that an evaporation pond overflowed, the environmental consequences of such an event would be minimal. Liquid radioactive waste would be processed to solid waste and shipped off the site.

Flooding events are discussed in Section H.2.1.3 of the EIS and were screened out as potential accident-initiating events because of design criteria to accommodate the probable maximum flood and because of the assumption that operational rules would preclude transport and emplacement operations whenever there were local forecasts of severe weather. A quantitative analysis of flood events (DIRS 104699-Jackson et al. 1984) concluded that the only radioactive material that extreme flooding could disperse to the environment would be decontamination sludge from the waste treatment complex. The doses resulting from such dispersion would be limited to workers, and would be very small (DIRS 104699-Jackson et al. 1984). A more recent study reached a similar conclusion (DIRS 101930-Ma et al. 1992). The effects of a beyond-design-basis earthquake are evaluated in Appendix H.

**7.4 (13104)**
**Comment** - 010227 / 0022
There are several new elements described in the SDEIS that have never been brought into the Yucca Mountain discussion before: on-site fuel cooling, and fuel blending pools. These surface facilities, as described, would not be able to get a license under NRC part 72 [10 CFR Part 72], due to seismicity. If they cannot meet those standards, already in place, how are they expected to protect public health and safety?

**Response**
Accidents involving the spent nuclear fuel storage modules in the surface aging facility and the Waste Handling Building (which includes the fuel blending facility) are evaluated in Section H.2 of the Final EIS. These facilities would be designed and constructed to comply with all applicable Nuclear Regulatory Commission licensing requirements that would include seismic design criteria specific to the repository.

**7.4 (13177)**
**Comment** - 010243 / 0024
Cleanup after accidents [fuel blending facility] will likely increase worker exposures and generate additional streams of LLW, Mixed Wastes, and possibly HLW.

**Response**
The same types of operations assumed in the Draft EIS would be involved in the blending process. Postulated accidents involving leakage or draining of the blending pools could produce larger amounts of contaminated water. However, the contamination levels in the water would be very low and such events would be accommodated with existing waste handling processes and equipment.

**7.4 (13276)**
**Comment** - 010231 / 0010
Page 3-l1, Section 3.1.8. Accidents. All of the doses to the maximally exposed individuals exceed by 2.5 to 3.2 times the current radionuclide NESHAPs [National Emission Standards for Hazardous Air Pollutants] standards. The information to determine these results should be provided.

**Response**
The information and analyses used to estimate the reasonably maximally exposed individual doses are provided in Appendix H. National Emission Standards for Hazardous Air Pollutants (40 CFR Part 61) are applicable only to routine or permitted releases. They do not apply to accidents. Since publication of the Draft EIS, the Environmental Protection Agency promulgated *Public Health and Environmental Radiation Protection Standards for Yucca Mountain, Nevada,* at 40 CFR Part 197, which included an annual dose limit to a member of the public of 15 millirem (40 CFR 197.4). In accordance with requirements of the Energy Policy Act, the Nuclear Regulatory Commission subsequently promulgated Yucca Mountain licensing criteria, which includes a Preclosure Public Health and Environmental Standard at 10 CFR 63.204 of 15 millirem per year to a member of the public. The appropriate sections of the EIS (including those mentioned in Chapter 8) have been updated to reflect a comparison to the recently promulgated standard of 15 millirem.

**7.4 (13278)**
**Comment** - 010143 / 0002
One of the things we're taking a look at, of course everybody has commented on this tonight at one time or another, is the introduction of a surface aging facility that will increase the complexity of waste handling, increase bare fuel handling activities, increase radioactivity waste generation, and one would expect increased both worker and public risk.

Somehow these additional risks, since the risks are in total, is predicted to decrease in new design. I haven't been able to figure that one out yet. The FEIS needs to explain how this risk is decreased.

**Response**
Accidental assembly drops during handling and loading operations are evaluated in Appendix H of the EIS, and impacts from such accidents are discussed in Section H.2.1.5. Releases from assembly drop accidents in the pool would be mitigated by retention of the pool water, and all accidents within the confines of the Waste Handling Building would be mitigated by the ventilation system, which would control the flow of any radioactive release and would filter any airborne discharge to the atmosphere. Misloading of a waste package could occur, and such an event could result in excessive temperatures. The possibility of such event has been considered, and it is expected that disposal container loading procedures would be developed based on thermal analyses of the various waste package configurations such that sufficient margin would be available to ensure that temperature criterion would not be violated for any credible misload (DIRS 150198-CRWMS M&O 2000).

It is true that, under higher- and lower-temperature operating modes, some impacts are predicted to be higher or lower than those presented in the Draft EIS for the three thermal load scenarios. Without more information, DOE cannot respond in more detail to the commenter's question. However, DOE believes that the estimated impacts presented in the Final EIS for the higher- and lower-temperature operating modes represent a range of environmental impacts that could occur.

Some accident impacts have decreased from those reported in the Draft EIS assessment due to the smaller amount of radioactive material that would be in the Waste Handling Building, a lower probability of failure estimated for the filtration system, and other factors. Section H.2.1.1 of the EIS describes these changes.

**7.4 (13321)**
**Comment** - 010318 / 0002
Radioactive waste should not be stored temporarily prior to approval of a permanent disposal site. Should an accident or sabotage occur, concentrating all the waste together at a temporary location will increase the danger to catastrophic proportions. The western states would be covered with radioactive contamination first, and it would spread across the midwest and to the east coast. The entire United States would be devastated.

**Response**
DOE does not intend to store all the waste temporarily at Yucca Mountain or any other location prior to approval of the proposed repository. Accidents during repository operations involving the spent nuclear fuel surface aging facility are examined in Section H.2.1, and long-term performance of the repository, including the effects of natural and human caused events on the entire waste package inventory, is evaluated in Chapter 5.

**7.4 (13369)**
**Comment** - 010182 / 0015
The SDEIS increases the number of ventilation shafts from 5 in the DEIS to a possible maximum of 17. Also, forced air is increased from 3.5 cubic feet to 530 cubic feet. "Fans at the surface ends of the exhaust shafts would provide the moving force for the subsurface repository airflow" (Page 2-22, Para 2). The SDEIS should consider the extent to which increased ventilation results in an enhanced exposure pathway. The SDEIS fails to consider that if the surface facilities and equipment were to fail, i.e., due to seismic activity, the electric power would be terminated and the ability to cool the repository would fail.

**Response**
Ventilation would be active to help remove heat from the emplacement drifts during the preclosure period. In the event of a ventilation failure, a very slow buildup of heat would begin in the repository. There would be no adverse consequences from this heat. For example, DOE evaluated other repository designs without active ventilation and results showed that repository performance would be acceptable. DOE has added the forced-cooling ventilation system as a conservative defense-in-depth feature to maintain a lower drift-wall temperature (described in the Supplement to the Draft EIS). If a fan failed, it could be repaired or replaced within several weeks; this would not cause any detectable impacts.

The exhaust system would be designed to prohibit the exhaust of radioactively contaminated air. Design of the repository ventilation system would include air monitoring for radioactivity and a feature to divert exhaust through high-efficiency particulate air filtration prior to exhausting if any radioactivity was detected.

The design of the repository ventilation system is still evolving. DOE would ensure that the final design met all requirements (including development of adequate maintenance and inspection programs) and received necessary peer reviews. In addition, the Nuclear Regulatory Commission would review the design before licensing a repository.

Although a greater amount of air would be moved through the repository with the increased ventilation for some of the flexible design repository operating modes, the source of pollutants would not increase proportionally. The source of pollutants would remain approximately the same, slightly larger, between the low ventilation rate [0.1 cubic meter per second (210 cubic feet per minute)] and the higher ventilation rate [15 cubic meters per second (32,000 cubic feet per minute) per drift]. As a result, the risk would only increase a small amount.

If the surface facilities failed and forced ventilation could not be maintained, the heat-up of the repository and disposal packages would be very slow. In a recent assessment, it was determined that the peak temperature of the waste package outer surface [ranging from 369° to 454°C (696°F to 849°F), depending on the assumptions made] would not occur until 15 years after a ventilation loss that took place immediately after emplacement. Thus, there would be ample time to restore ventilation prior to any significant waste package degradation from overheating. In addition, current plans include provisions for a high-efficiency particulate filtration system that could be used to filter the ventilation flow and eliminate most of the radionuclide particulate release to the atmosphere if any radionuclide releases occurred in the underground.

**7.4 (13390)**
**Comment** - 010182 / 0030
The SDEIS should analyze alternatives if the surface facilities and support should fail.

**Response**
If the surface facilities failed and forced ventilation could not be maintained, the heat-up of the repository and disposal packages would be very slow. Recent assessment, (DIRS 148608, CRWMS M&O 2000) determined that the peak temperature of the waste package outer surface [ranging from 369°C to 454°C (696°F to 849°F), depending

on the assumptions made] would not occur until 15 years after a ventilation loss that took place immediately after emplacement. Thus, there would be ample time to restore ventilation prior to any significant waste package degradation from overheating. In addition, current plans include provisions for a high-efficiency particulate filtration system that could be used to filter the ventilation flow and eliminate most of the radionuclide particulate releases to the atmosphere if any radionuclide releases were to occur in the underground.

## 7.4.1 SABOTAGE

**7.4.1 (61)**
**Comment** - 22 comments summarized
Commenters expressed concern that a repository would represent an attractive target for sabotage. These concerns included the accumulation of all of the waste material at one location and extended to both during the active operation of the repository, monitoring, and the period after closure of the repository.

**Response**
The intent of the Nuclear Waste Policy Act of 1982 is to provide for the siting, construction, and operation of a deep geologic repository for spent nuclear fuel and high-level radioactive waste that would protect the public and the environment from the hazards of these materials. Over the long term (after closure), deep geologic disposal of spent nuclear fuel and high-level radioactive waste would provide optimal security by emplacing the material in a geologic formation that would provide protection from inadvertent and advertent human intrusion, including potential terrorist activities. The use of robust metal waste packages to contain the spent nuclear fuel and high-level radioactive waste more than 200 meters (660 feet) below the surface would offer significant impediments to any attempt to retrieve or otherwise disturb the emplaced materials.

In the short term (prior to closure), the proposed repository at Yucca Mountain would offer certain unique features from a safeguards perspective: a remote location, restricted access afforded by Federal land ownership and proximity to the Nevada Test Site, restricted airspace above the site, and access to a highly effective rapid-response security force. Refer to Section 4.1.8.43 of the EIS for additional information.

Excavation of emplaced materials after closure of a repository would take approximately the same level of effort it has taken DOE to excavate the current Exploratory Studies Facility. In other words, it would take years with sophisticated excavation equipment, a large workforce, and significant expenditure of funds — all unlikely to happen without being highly visible to the Government and the public. For this reason, it is unlikely that such activity would ever take place. Even if terrorists were able to penetrate to repository depth, the spent nuclear fuel and high-level radioactive waste would be in waste packages weighing between 32 and 82 metric tons (35 and 90 tons), each made of thick solid metal (stainless steel and Alloy-22). Without the ventilation systems and remotely operated emplacement equipment used for handling of the waste packages, potential terrorists probably would not survive the high temperatures and high radiation fields that would exist. Therefore, it is unlikely that terrorists could remove or cause major damage to a waste package.

DOE believes that the repository would also not be an attractive target for saboteurs during operation. Based on experience at other DOE facilities, sabotage attempts would be unlikely. In addition, impacts from such events would be unlikely to exceed impacts from the severe seismic event considered in Appendix H of the EIS, which would cause total collapse of the Waste Handling Building and the Waste Treatment Building and damage to fuel assemblies out of the storage pools. Due primarily to the remoteness of the site, DOE believes that the likelihood and consequences of sabotage events would be greater during transportation to the repository (see Section H.2.1.3). Appendix J discusses such impacts. Furthermore, DOE intends to fully comply with Nuclear Regulatory Commission regulations that require the protection of spent nuclear fuel and high-level radioactive waste from radiological sabotage.

With respect to the impact of nuclear warheads directed at the repository, it is unlikely that the detonation of such weapons at or above the surface of the repository would significantly enhance the release of radiation associated with the weapon itself. The average 300-meter (1,000-foot) rock overburden plus the very robust waste packages and ground support structures would minimize the potential for release from the waste packages following such an event.

**7.4.1 (10862)**
**Comment** - 010062 / 0001
First, I am concerned about human intervention in safe storage. Primarily, I worry about warfare between nations as a source of disruption of a 10,000-year safe storage forecast. I do not believe we can protect more than a few days at a time globally. I do believe that thousands of strategic nuclear warheads capable of penetrating and destroying Yucca Mountain's facilities currently are deployed by China, France, Israel, India, Pakistan, Russia, and the United Kingdom. My knowledge of chemical, biological, and laser weaponry is far less developed, but I would suggest scenarios for each type of weapon could be devised which might successfully breach the defenses planned for Yucca Mountain's facility.

I see Yucca Mountain as a logical target for opponents of the United States in coming years if the project gets approval and recommendation from the President. The aim of an opponent at war with the United States would be to employ an attack upon the waste storage facility to foul or contaminate large portions of the United States with radioactivity, thereby harming our population with air and water pollution.

Has anyone studied the size of nuclear warhead necessary to penetrate Yucca Mountain to repository depth? The potential for laser weapons would seem to be another source of concern for transportation packages, if eco-terrorists were in control of such a device. Please examine the threats existing weaponry could pose to the project and publicize your resulting analysis before agreeing to sign off on such a facility.

Terrorist activity by political opponents of waste emplacement at Yucca Mountain is a further concern—domestic opposition has a history of ability to mobilize thousands for protests. I would anticipate such opposition for the transportation schedule particularly in the northeast. The question is how far would opponents go to make the facility unusable? Would they:

A. Detonate explosives to foul the rail/truck vehicles or freeways/rail routes?
B. Attack a transport vehicle to prevent successful transport?
C. Seek to damage entry portal facilities?
D. Seek to detonate bomb(s) in the repository area?
E. Try to sabotage transport vehicles, routes, or the Yucca Mountain facility in other ways?

The domestic opposition has a history of more than 30 years. I used to be part of that sentiment. My conversion came as a result of reading, study, and monitoring about cask technology and performance of ISFSIs [independent spent fuel storage installations], especially at Prairie Island 1 and 2 near Red Wing, Minnesota. I would have advised broad public education as the strongest deterrent to domestic opposition.

International terrorists represent a whole different level of threat to such a waste repository. I could conceive of people within Iraq, for instance, who might try to bomb the north portal to prevent waste emplacement. If such people were to wait their attack until significant waste was at repository level and used an atomic bomb placed at repository level, would the resulting blast be capable of breaching casks and enhancing radioactive pollution of air quality in the United States?

Recently a news broadcast suggested Vladimir Putin of Russia was offering Russian facilities for nuclear waste storage generated by other nations. That puts the United States in a competition mode, conceivably, for access to waste produced elsewhere. Is this an attempt to gain materials for reprocessing to expand weapon arsenals with more reliable warheads?

Does the concentration of nuclear waste in one area commit the United States to a military defense of that facility? Has DOE covered that contingency or is that a DoD [Department of Defense] policy/providence?

**Response**
DOE believes that it is unlikely the detonation of nuclear weapons at or above the surface of the repository would significantly enhance the release of radiation associated with the weapon itself. The average 300-meter (1,000-foot) rock overburden plus the very robust waste packages and ground support structures would minimize the potential for release from the waste packages following such an event. Furthermore, due to the remoteness and nonstrategic nature of the facility, it is unlikely that the repository would represent a favorable target to foreign aggressors. DOE

has examined sabotage events involving shipment of spent nuclear fuel and high-level radioactive waste to the repository. The impacts of this event are provided in Sections 6.2.4.2.3 of the EIS. Sabotage events at the repository would be unlikely due to access control, and would result in diminished impacts due to the remoteness of the facility (see Section H.2.1.3).

With respect to the comment regarding competition with Russia for nuclear waste storage facilities, DOE does not intend to emplace any waste other than that considered in the EIS.

DOE has not committed to a military defense of the facility, but the proposed repository at Yucca Mountain would offer certain unique features from a safeguards perspective: a remote location, restricted access afforded by Federal land ownership and proximity to the Nevada Test Site, restricted airspace above the site, and access to a highly effective rapid-response security force. During operations, security measures would deter human intervention, and the deep geologic emplacement would preclude the necessity for military defense after emplacement.

**7.4.1 (13176)**
**Comment** - 010243 / 0023
Deliberate sabotage also becomes easier and more likely with the additional step of fuel handling.

**Response**
Blending is the selective loading of fuel assemblies to control waste package temperatures. Blending operations would be performed within security controlled areas, so sabotage would be unlikely. Blending operations would involve basically the same handling operations that would occur without blending. Fuel assembly drops, which could occur during blending operations, are considered in the accident analyses in Appendix H of the EIS.

DOE believes that the safeguards applied to the proposed repository should involve a dynamic process of enhancement to meet threats, which could change over time. Repository planning activities would continue to identify safeguards and security measures that would further protect fixed facilities from terrorist attack and other forms of sabotage.

## 7.4.2 EMERGENCY RESPONSE

**7.4.2 (399)**
**Comment** - EIS000067 / 0001
Table 6-20 (Pg. 6-57) identifies impacts to workers from industrial hazards during construction and operation. In Esmeralda County and the nearby sections of Nye County along U.S. 95 there are no medical facilities. Esmeralda County needs to have assistance from DOE to be able to have the facilities in order to provide the medical help for ill or injured workers.

**Response**
Section 116(c) of the NWPA states that "the Secretary shall provide financial and technical assistance to [an affected unit of local government or the State of Nevada]…to mitigate the impact on such [an affected unit of local government or the State of Nevada] of the development of [a] repository and the characterization of [the Yucca Mountain] site." Such assistance can be given to mitigate likely "economic, social, public health and safety, and environmental impacts." Within that broad framework, neither Section 116 nor any other provision of the NWPA limits the impacts that are subject to assistance under Section 116 to the environmental impacts considered in this EIS.

Under the NWPA, the Section 116 impact assistance review process and the EIS process are distinct from one another, and the implementation of one would not depend on the implementation of the other. Thus, the provision of assistance under Section 116 would not necessarily be limited either by the impacts identified in this EIS or by its findings on such impacts. Any decision to provide assistance under Section 116 would be based on an evaluation of a report submitted by an affected unit of local government or the State of Nevada pursuant to Section 116 that documented likely economic, social, public health and safety, and environmental impacts. DOE would enter into discussions with the State of Nevada and affected units of local government and consider appropriate support and mitigation measures.

After a decision on the proposed repository and transportation modes and routes, local jurisdictions would be better able to identify the likely economic, social, public health and safety, and environmental impacts that would be the basis for a request for economic assistance, which might include assistance in providing additional medical and emergency response facilities, under Section 116(c) of the NWPA.

Further, as required by Section 180(c) of the NWPA, DOE would provide technical assistance and funds to states for training public safety officials of appropriate units of local government and Native American tribes through whose jurisdictions the DOE would transport spent nuclear fuel and high-level radioactive waste. Training would cover procedures required for safe routine transportation of these materials, as well as procedures for dealing with emergency response situations. In addition, Sections 116(a) and 117(c)(5) of the NWPA set forth assistance guidelines covering a number of issues, including emergency preparedness and response, state liability arising from accidents, and necessary road upgrading.

**7.4.2 (432)**
**Comment** - EIS000080 / 0003
Nye County must, as a mitigation measure, be given the wherewithal to implement and comprehend a wellhead protection program in the communities of Beatty, Amargosa Valley and Pahrump where these wastes are going to be traveling through.

These same mitigation measures would carry over to our neighboring counties like Goldfield along the route and White Pine County and Lincoln County, as well.

Part of wellhead protection is providing an emergency response capability if there is an accident. No matter how much you plan, no matter how well prepared you are, things still happen.

Nye County must be in the position to be prepared for it when it happens, not react to it after it happens.

**Response**
The EIS evaluates the potential for repository activities to affect both water availability and water quality. The updated analysis in the Final EIS projects that the Proposed Action would likely result in extremely small releases of radioactive contamination to the environment in the first 10,000 years after repository closure (thousands of times less than the individual protection standard set by 40 CFR Part 197). However, DOE does not believe a well head protection program would be appropriate because the possibility of a transportation accident affecting groundwater would be remote. A paper by R. M. Ostmeyer (DIRS 157052-Ostmeyer 1986) analyzed the potential importance of water pathway contamination for spent nuclear fuel transportation risk using a "worst-case" water contamination scenario. The analysis showed that the impacts of the water contamination scenario might also affect groundwater resources, but to much lower levels of contamination than surface water because of the delay associated with the infiltration of meteoric water to groundwater. Therefore, the results of the analysis indicate that water-pathway contamination would not be a significant contributor to the radiological risks of transporting spent nuclear fuel. In the unlikely event of a transportation accident that involved contamination of surface water or groundwater, DOE would cooperate with other responding agencies in implementing all appropriate remedial actions.

**7.4.2 (807)**
**Comment** - EIS000103 / 0005
There are again -- the most important thing here. There are no medical county facilities in Nye County or Nellis Air Force Base or NTS [Nevada Test Site] or the Tonopah Test Site.

There is nothing on [I] 95 or [I] 160 to handle emergencies or what have you for our soon to be 60,000 to 120,000 people in Pahrump, and therefore I've asked Senator Reid to call in our markers and I've submitted a report and asked Nevada Bell who has overcharged us patrons down here and throughout the northern Nevada 5.4 million and they're putting into the rural community so they can make money for virtual schools, virtual libraries and virtual medicine 4.3 million.

At the last NWTRB [Nuclear Waste Technical Review Board] meeting, I asked Lake Barrett if he would put 50 million into his budget, and he said he would for next year.

I of course then attacked Carl Gertz and his M&O [Management and Operating Contractor] man working and asked him for 50 million, and so now it's quite up to Senator Reid to get us a hundred million for virtual medicine throughout Nye County, and as you know, we're the third largest in the world.

We have nothing, we will have nothing and this has never been considered, and so it's up to our brave senator not only to get this money or from private sources like Iowa did, 17 million and the whole state has virtual medicine.

**Response**
Section 116(c)(2) of the NWPA requires the Secretary of Energy to provide financial assistance to the State of Nevada and any affected unit of local government requesting such assistance to mitigate the impacts of the development of a repository and characterization of the site. The State and any affected unit of local government may request such assistance by preparing and submitting a report on the likely economic, social, public health and safety, and environmental impacts. After a decision was made regarding the proposed repository and transportation modes and routes, local jurisdictions would be better able to identify the likely economic, social, public health and safety, and environmental impacts that would be the basis for a request for economic assistance, which could include assistance in providing additional medical and emergency response facilities under Section 116(c) of the Act. DOE would enter into discussions with the State of Nevada and affected units of local government and consider appropriate support and mitigation measures.

**7.4.2 (1262)**
**Comment** - EIS000228 / 0006
The description of emergency management impacts is of critical concern to Clark County. The NEPA [National Environmental Policy Act] obliges Federal agencies to examine the direct effects of their programs. The DEIS fails to accomplish this by providing a thorough description of the emergency response system necessary to respond to the Maximum Reasonably Foreseeable Accident (MRFA). Discussion of the MRFA is so sparse that emergency response professionals do not have sufficient information to define their response requirements. The DEIS should have provided a more thorough description of the communications, security, packaging, and transportation systems deployed to mitigate accidents as well as the MRFA. No description of how the DOE will implement the emergency response sections of the Nuclear Waste Policy Act (section 180c) is provided.

**Response**
DOE intends to fully implement the provisions of Section 180(c) of the NWPA, which requires the Secretary of Energy to provide technical assistance and funds to public safety officials of appropriate units of local government and Native American tribes through whose jurisdictions transportation of spent nuclear fuel and high-level radioactive waste would occur. However, it is not the purpose of the EIS to provide all of the information necessary to develop the procedures and training necessary for safe routine transportation of these materials and for dealing with emergency response situations.

The Final EIS identifies mostly rail as the preferred mode of transportation nationally and in Nevada, but does not identify a preferred route. If the repository was approved and further work is done on the selection of the branch rail line from among the alternatives identified, and the specific alignment of the branch rail line, additional information would become available that would allow for better identification of the maximum reasonably foreseeable accidents and the necessary emergency response procedures and capabilities to deal with such accidents.

**7.4.2 (2405)**
**Comment** - EIS000653 / 0002
One of these gaps in particular is the description of the emergency management impacts. These are of critical concern to Clark County. NEPA [National Environmental Policy Act] obliges Federal agencies to examine the direct effects of their programs on local communities. The DEIS fails to accomplish this by failing to provide a thorough description of the emergency response system necessary to respond to the maximum reasonably foreseeable acts of the MRFA [Maximum Reasonably Foreseeable Accident]. Discussion to have MRFA is so sparse that our emergency response professionals did not feel they had enough information to define their response requirements.

The DEIS should have provided a more thorough description of the communications, security, packaging and transportation systems deployed to mitigate accidents as well as the MRFA.

No description of how the DOE will implement emergency response sections of the Nuclear Waste Policy Act, Section 180c is provided.

**Response**
DOE intends to fully implement the provisions of Section 180(c) of the NWPA, which requires the Secretary to provide technical assistance and funds to public safety officials of appropriate units of local government and Native American tribes through whose jurisdictions transportation of spent nuclear fuel and high-level radioactive waste would occur. However, it is not the purpose of the EIS to provide all of the information necessary to develop the procedures and training necessary for safe routine transportation of these materials and for dealing with emergency response situations.

The Final EIS identifies mostly rail as the preferred mode for both national and Nevada transportation, but does not identify a preferred route. Assuming that the site was designated and DOE selected the mostly rail mode, as further work is done on the selection of the branch rail line from among the alternatives identified, and the specific alignment of the branch rail line, additional information would become available that would allow for better identification of the maximum reasonably foreseeable accidents and the necessary emergency response procedures and capabilities to deal with such accidents.

**7.4.2 (6149)**
**Comment** - EIS001654 / 0024
Page S-51. Emergency Services Adequacy Questioned

The conclusion that "a large impact on the emergency services of surrounding communities or counties would be unlikely" needs to be demonstrated. The statement suggests that the repository site will be managed largely on a self-sufficient basis. That will be necessary because of the nature of the facility and its pre-closure construction and operations (we also would expect this to be a requirement of the operating license.) From our observations, the resources in Nye County for this kind of support are meager and the resources in Las Vegas metropolitan area are mal-positioned to be of value in emergency situations at the site.

**Response**
This comment is correct that repository operations would be largely self-sufficient with respect to emergency services, which DOE would coordinate with emergency services at the Nevada Test Site. Because of the distances involved, Clark County would not be well positioned to provide emergency services. Further, some of the types of emergency services would not be available from Nye County (for example, mine rescue or radiological response).

Outside the National Environmental Policy Act framework, the NWPA establishes a process by which DOE can assist the State of Nevada and affected units of local government in funding emergency response capabilities. Section 116(c) of the NWPA states that "the Secretary shall provide financial and technical assistance to [an affected unit of local government or the State of Nevada]… to mitigate the impact on such [an affected unit of local government or the State of Nevada] of the development of [a] repository and the characterization of [the Yucca Mountain] site." Such assistance can be given to mitigate likely "economic, social, public health and safety, and environmental impacts." Within that broad framework, neither Section 116 nor any other provision of the Act limits the potential scope of impacts that are appropriate for consideration under Section 116 to the environmental impacts considered in this EIS.

Beside the Payments-Equal-to-Taxes program already being implemented under Section 116(c)(3) of the NWPA, any decision to provide other assistance under Section 116(c) would be based on an evaluation of requests from affected units of local government or the State of Nevada pursuant to Section 116(c)(2) that document likely economic, social, public health and safety, and environmental impacts.

**7.4.2 (7241)**
**Comment** - EIS001337 / 0112
Page 6-57 Table 6-20 identifies impacts to workers from industrial hazards during construction and operation. In rural Nevada, access to emergency medical care is limited and challenging. These communities need financial assistance from DOE to be able to have the appropriate facilities and personnel to provide proper medical help for ill or injured workers and their families.

**Response**
DOE would initiate discussions with potentially affected units of local government and consider appropriate support and mitigation measures. Further, under the NWPA, Congress has established an impact assistance review process that is distinct from the Yucca Mountain Repository EIS process. The implementation of one process would not depend on implementation of the other. Thus, the impact findings identified in this EIS would not bar the provision of assistance under Section 116 of the NWPA. A decision to provide assistance would be based on evaluation of a report submitted by an affected unit of local government or the State of Nevada pursuant to Section 116 that documented likely economic, social, public health and safety, and environmental impacts.

**7.4.2 (9779)**
**Comment** - EIS001888 / 0363
[Clark County summary of comments it has received from the public.]

Although some ER [emergency response] management activities are in place, the ability to get special equipment on site quickly is not resolved. Also, the substance, timing, and magnitude of federal assistance to local government is uncertain.

**Response**
The ability to get special equipment on site quickly is not required at present. Even if approved by Congress, repository construction would not begin for a number of years and transportation of spent nuclear fuel and high-level radioactive waste to the Yucca Mountain site and placement in the repository would not begin before 2010. The type of special equipment needed would depend on the selected mode of transportation. DOE would work with the appropriate government agencies to ensure adequate planning, equipment, and trained personnel for any circumstances that would call for emergency response.

Under the NWPA, DOE has various means to evaluate the merits of providing compensation to the State of Nevada and affected units of local government on behalf of their citizens. For example, under Section 116(c) of the Act, the State or affected unit of local government can request financial assistance from DOE. Such assistance "shall be designed to mitigate the impact on such State or affected unit of local government of the development of such repository and the characterization of such site." In addition, under Section 114(a)(1) of the Act, the State or affected unit of local government can prepare a report on the likely economic, social, public health and safety, and environmental impacts that could result from a repository, which DOE can consider as part of its site recommendation process. Section 180(c) of the NWPA requires the Secretary of Energy to provide technical assistance and funds to states for training public safety officials of units of local government and Native American tribes through whose jurisdictions DOE would transport spent nuclear fuel and high-level radioactive waste.

**7.4.2 (9948)**
**Comment** - EIS001888 / 0474
[Clark County summary of comments it has received from the public.]

Expansion of use of NTS [Nevada Test Site] will result in additional ER [emergency response] costs for county and local government. This should be included in EIS and paid for by DOE.

**Response**
Chapter 9 of the EIS describes mitigation measures that DOE could undertake to reduce the potential impacts of the repository. In addition, Section 116(c) of the NWPA states that "the Secretary shall provide financial and technical assistance to [an affected unit of local government or the State of Nevada]…to mitigate the impact on such [an affected unit of local government or the State of Nevada] of the development of [a] repository and the characterization of [the Yucca Mountain] site." Such assistance can be given to mitigate likely "economic, social, public health and safety, and environmental impacts." Within that broad framework, neither Section 116 nor any other provision of the NWPA limits the impacts that are subject to assistance under Section 116 to the environmental impacts considered in this EIS.

Under the NWPA, the Section 116 impact assistance review process and the EIS process are distinct from one another, and the implementation of one would not depend on the implementation of the other. Thus, the provision of assistance under Section 116 would not necessarily be limited either by the impacts identified in this EIS or by its

findings on such impacts. Any decision to provide assistance under Section 116 would be based on an evaluation of requests for assistance from affected units of local government or the State of Nevada pursuant to Section 116 that documented likely economic, social, public health and safety, and environmental impacts. DOE would enter into discussions with the State of Nevada and affected units of local government and consider appropriate support and mitigation measures.

Assuming the proposed repository site was designated and transportation modes and routes were determined, local jurisdictions would be better able to identify the likely economic, social, public health and safety, and environmental impacts that would be the basis for a request for economic assistance, which could include assistance in providing additional medical and emergency response facilities, under Section 116(c) of the NWPA.

**7.4.2 (11982)**
**Comment** - EIS000235 / 0008
The Final EIS should consider implementation of the Radiological Emergency Response Plan for the Grover C. Dils Medical Center as a possible mitigation measure.

**Response**
It is premature to commit to specific mitigation measures related to transportation until decisions regarding the proposed repository and specific modes and routes of transportation, if appropriate, have been made.

Closer to the time that transportation would occur, DOE would provide technical assistance and funds to states for training for public safety officials of appropriate units of local government and Native American tribes through whose jurisdictions transportation of spent nuclear fuel or high-level radioactive waste would occur. This assistance is required by Section 180(c) of the NWPA, and is required to cover procedures for safe routine transportation and also for dealing with emergency response situations.

In addition, Section 116(c) of the NWPA allows the Secretary of Energy to provide financial and technical assistance to the State of Nevada and any affected unit of local government requesting assistance to mitigate impacts of the development of the repository.

# 7.5 Repository Affected Environment and Impacts

## 7.5.1 LAND USE

**7.5.1 (106)**
**Comment** - 32 comments summarized
Commenters are concerned that the size of the land withdrawal area would result in too much land taken away from the public and Native Americans. Commenters felt the EIS should provide a justification for such a large area and address the impacts of removing such a large piece of public land. Issues included: basis of 12-mile distance to southern boundary, status of current land ownership, intrusion onto the town boundaries of Amargosa Valley, ability to maintain the withdrawal area after repository closure, existence of environmental management sites within the proposed withdrawal area, and impacts on current land uses.

**Response**
As discussed in Sections 3.1.1.3 and 4.1.1.1 of the EIS, regulations issued by the Nuclear Regulatory Commission require that land for the repository be either under the jurisdiction and control of DOE or permanently withdrawn and reserved for its use (10 CFR 63.120). Furthermore, the Nuclear Regulatory Commission regulations require the repository operations areas and postclosure controlled areas to be free and clear of encumbrances such as (1) rights arising under the general mining laws, (2) easements or right-of-ways, and (3) all other rights arising under lease, rights of entry, deed, patent, mortgage, and appropriation or prescription. Only Congress has the power to withdraw Federal lands permanently for the exclusive purpose of a specific agency and any other uses of the lands would be subject to conditions of the withdrawal. As a practical matter, DOE control of the surface and subsurface estates would reduce the potential for human actions that could adversely affect the repository's ability to isolate the waste.